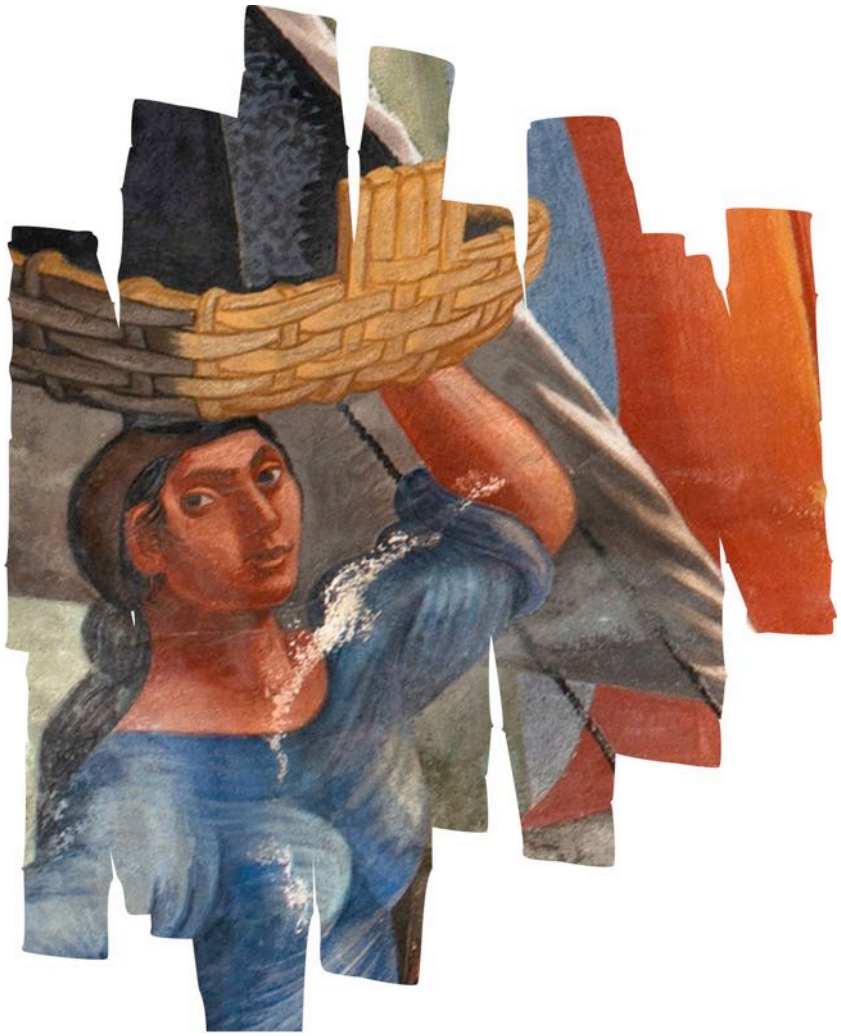
BOOK OF ABSTRACTS

colours 22

BRIDGING SCIENCE WITH ART

Modern and contemporary artworks



BOOK OF ABSTRACTS
COLOURS 2022

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CONTENTS

WELCOME TO COLOURS2022

Dear Colleagues,

It is with great pleasure that we welcome you in the third edition of the Conference **COLOURS: Bridging Science with art**. Hosted by the University of Évora and organized by HERCULES Laboratory to celebrate Modern and contemporary Art.

COLOURS2022 is made under the framework of project ALMADA: Unveiling the mural painting Art of Almada Negreiros (1938-1956): technical, material, and diagnostic scientific study as guide for its future conservation and enjoyment. Almada Negreiros was a key artist of Portuguese Modern Art from the first half of the 20th century, and he has left in the city of Lisbon a rich opus of mural paintings still to be discovered by the International Art world.

The third conference of COLOURS: bridging science to ART intends to pay homage to Almada Negreiros and to all contemporary and following artist generations who worldwide have combined old colour traditions with new painting materials and techniques. COLOURS2022 is a unique opportunity to discuss them together and the challenges that the safeguard of their works of art face nowadays.

In the next 3 days it is going to be all about COLOURS in its wide perspective in cultural heritage and conservation science. The scope as in previous editions is to:

- Promote a forum between the several disciplines that study colour in its wide perspectives in art: chemistry and physics, psychology, archaeology, geology, history, history of art, visual arts, architecture and conservation-restoration.
- Bring together scientists, from both analytical and conservation fields, artists and institutions to discuss the most recent advances in technology applied to colour imaging, diagnosis, conservation and management of cultural heritage.

We wish you all a pleasant journey in Évora.

On behalf of the Organization Committee, Milene Gil and António Candeias (chairs).

ABOUT ALMADA NEGREIROS AND PROJECT ALMADA

José Sobral de Almada Negreiros (1893-1970) is one of the key figures of the avant-garde and modernism in Portugal. Since his first group exhibition in 1911, and his futuristic intervention in 1916-1918, he marked the artistic and cultural scene through a multifaceted career of almost sixty years in Portugal and in Spain. From 1919 to 1920, Almada Negreiros lived in Paris and from 1927 to 1932 in Madrid, where he established himself as an artist and he was part of the main cultural and artistic gatherings, collaborating on projects with several other authors from the Madrid cultural scene. Having returned to Portugal, he witnessed the emergence of the Estado Novo (1933-1974), in the context in which he worked on various public and private work commissions. Most of the mural paintings he executed for public assignments were integrated into architectural projects by the architect Porfírio Pardal Monteiro. The vast mural work by Almada Negreiros includes five mural painting nucleus made in the city of Lisbon between 1938 and 1956. Among the best known are the five panels of the former headquarters of Diário de Notícias (1939-40), the eight monumental panels of waiting room at the Gare Marítima de Alcântara (1943-45) and six other analogues at the Gare Marítima da Rocha do Conde do Óbidos (1946-49). Recognized for its value in modern art historiography, these monumental works of art have been widely discussed regarding their plastic, iconographic and symbolic attributes. Yet, few studies addressed the particularities of the productions, the artistic references, and the influences of his murals among peers and younger generations. Even less was known about the materials of Almada 's murals and the implications on its conservation. All his mural paintings are classified as frescoes, but this may not have been the only pictorial technique used according to previous surveys of Conservator-restorers.

The materials employed and the modus operandi of Almada Negreiros are practically unknown. Almada was knowledgeable in the fresco art while still an experimentalist. To what extent was he innovative, what were his artistic sources and trends as a mural painter, are questions addressed for the first time on project ALMADA using three approaches:

A) Art history (including technical) documental research to place the murals in their historical and artistic context.
B) On-site surface examinations of the murals using conventional and advanced imaging techniques in the visible and invisible range.
C) Material characterization combining non-invasive in loco analysis with microscopic and advanced analytical laboratory techniques.

The objectives are to identify and characterize the unknown pictorial techniques, plaster materials and paint layers, and determine their implications in the deterioration process which is essential for their future conservation. This transdisciplinary project is a collaboration between HERCULES laboratory, the General Directorate of Cultural Heritage, Institute of Art History of the University Nova of Lisbon and Lisbon Port Admnistration (APL). The results obtained over the three years will be a vital step forward in the knowledge, valorization, and conservation of Almada Negreiros mural art.

Website of ALMADA project: https://almadanegreiros.uevora.pt/

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— Tiago Cerveira

INVITED SPEAKERS

— Katherine Schilling	Yale, USA
— Leslie Rainer	Getty Conservation Institute, USA
— Claudia Nunes	PHAN, Brasil
— Mercedes Sanchez Pons	Universitat Politècnica de València, Spain
— Mariana Pinto dos Santos	Instituto de História de Arte da FCSH-UNL, Portugal

CONFERENCE PROGRAM

DAY 1 - Wednesday, 14 September

09:00-10:00	Registration and check in at Colégio do Espirito Santo (auditorium 131)
10:00-10:30	Opening cerimony
10:30-11:00	**Plenary Lecturer 1** *Almada Negreiros' work under, for and about the Portuguese dictatorship of the Estado Novo.* Mariana Pinto dos Santos
11:00-11:30	Coffee break
Session 1: Colour history and symbolism in the 20 and 21th centuries	
11:30-11:50	**01.** *On the study of Porto's murals (1930-1970): state of the art and preliminary results.* Monteiro, P. T., Vieira, E., Gil, F., and Castro, L.
11:50-12:10	**02.** *Decoding a drawing: Igreja de Nossa Senhora de Fátima glass works colour scheme.* Simão Palmeirim
12:10-12:30	**03.** *Colours, inspiration, and history behind Gilda Gelmini Neuberger (1811-2011).* Gláucia Wanzeller, Teresa Ferreira and Milene Gil
12:30-14:00	Lunch
Session 2: Old and new colour materials and their origin/manufacture/uses	
14:00-14:20	**04.** *Madder lakes; Reproduction of recipes, chromatic variation and denominations.* De los Reyes, B., Chércoles Asensio, R., San Andrés Moya, M.
14:20-14:40	**05.** *Sustainable glasses for art and design.* Andrea Ruivo
14:40-15:00	**06.** *Andy Warhol and His Amazing Technicolor Shoes: Characterizing Early Synthetic Dyes used in À la recherche du shoe perdu and Dr. Ph. Martin's Radiant Concentrated Watercolors.* Abed Haddad, Toni-Nakie-Miller, Josephine Jenks, Glen Kowach and Art Kaplan
15:00-15:20	**07.** *Complementary study of 27 paintings from MUNCH collection using MFT and pXRF techniques* Irina Crina Anca Sandu, Tomasz Lojewski and Inger Grimstad
15:20-15:40	**08.** *Non-destructive analysis of the early Isolani Collection at Pratt Institute.* E. Del Federico, A.Yong, A.Steinfeld, E.Liporace, A. Jerschow, N. Barbi, L. Banner, and R. Miracco
15:40-16:00	**09.** *Dartecor – Handmade Colors.* Leonel da Costa
16:00:16:30	Coffee break
16:30 - 17:00	**Plenay Lecturer 2** *What We Can Learn from Each Other.* Katherine Schilling
17:00-18:00	Posters session
18:30-20:30	Alentejo de honra (welcome reception at D. Manuel Palace, Évora public garden)

DAY 2 - Thursday, 15 September

09:00-09:30	**Plenary Lecturer 3** *Children's Games - A large painting by Candido Portinari at Gustavo Capanema Palace – RJ, Brazil* Claudia Nunes, Carolina Barata, Maria Aguiar, Roberto Carlos da Conceição Ribeiro, Rosana Elisa Coppedê Silva, Caroline Martins de Souza and Michelle Teixeira Cassiano
Session 3: Colour deterioration (origin, types, mechanisms)	
09:35-09:55	**10.** *Degradation of pigments in street murals: in-situ and laboratory Raman studies.* Bersani Danilo, Laura Fornasini, Rousaki Anastasia, Vandenabeele Peter, Berzioli Michela, Saccani Ilaria
09:55-10:15	**11.** *Acrylic colours for peace: study and conservation of an outdoor mural painting.* Nathael Cano, Ricardo Medina, María Fernanda Urbina, Valeria López
10:15-10:35	**12.** *Colours of modernism in Edvard Munch's paintings from Warnemünde period.* Irina Sandu, Jin Ferrer, Francesca Rosi, David Buti, Letizia Monico, Donata Magrini, Claudio Costantino, Laura Cartechini, Aldo Romani, Costanza Miliani, Francesco P.Romano, Claudia Caliri, Claudia G. Fatusso, Giulia Privitera, Zdenk Preisler, Raffaella Fontana, Anna Impallaria, Emanuela Grifoni, Marco Raffaelli, Jana Striova, Christine Andraud and Aurélie Tournié
10:35-10:55	**13.** *Study of influence of zinc white pigment in Aurélia de Sousa self-portraits.* Maria Aguiar, Carolina Barata and Ana Cabral
10:55-11:20	Coffee break
11:20-11:40	**14.** *An Insight into the Green Deteriorated Mural Paint Layers at the Maritime Station of Alcântara (Lisbon): first results of an Archeometric Study* Andrea Acevedo Mejía, Mafalda Costa, Peter Vandenabeele, Luis Dias , Ana Manhita and Milene Gil
11:40-12:00	**15.** *Preliminary diagnostic Survey of 1947-1949 Paint Layers at the Maritime Station of Rocha Do Conde De Óbidos, Lisbon: A Multi Analytical Research.* Keelie S. Rix, Luis Dias, Sara Valadas, Ana Cardoso, Ana Manhita and Milene Gil
Session 4: Science and Technology applied to colour studies	
12:00-12:20	**16.** *Images study and material characterization of the double-sided painting The Cellist and Portrait of Brancusi by Amedeo Modigliani.* Greta García and David Juanes
12:20-12:40	**17.** *Cobalt pigments and the spectrum of colours they create.* Elena Davanzo and Gianluca Pastorelli
12:40-13:00	**18.** *António Carneiro's painting collection from the Museu da Cidade do Porto: Study and conservation in the 150th anniversary of the painter's birth.* Carolina Barata, Ana Cabral, Maria Aguiar and Laura Castro
13:00:14:00	Lunch
14:00-14:20	**19.** *XIX- XX century inks: disclosing the composition and the degradation mechanism of dyes in historical collection.* Adele Ferretti, Ilaria Degano, Stefano Legnaioli, Beatrice Campanella and Maria Perla Colombini
14:20-14:40	**20.** *Color and technique in the contemporary painting collection of the Universitat de València, Spain. The landscapes of the painter Manuel Moreno Gimeno.* Ma. Luisa Vázquez de Á. Pascual, Ester A. Pagán, Álvaro S. García, Susana H. Sala, Lucía R. Iranzo and Juan Carlos I. Garay

14:40-15:00	**21.** *Orthodox icons and wall painting in Serbia - from tradition to the modernity and back.* Daniela K. Crkvenjakov, Theodore Ganetsos, Velibor Andrić and Olivera Klisurić
15:00-15:20	**22.** *Comparative study of two multispectral imaging systems on the Arxiu Valencià del Disseny interior design samples.* Álvaro Solbes García, Mar Gaitán Salvatella, Javier M. Fernández and Ester A. Pagán
15:20-15:40	**23.** *Colour and technique in a 1969 - Portuguese painting A portrait of 'Faiunça' by Armando Matos Simões (1933–).* Vasco Montenegro, Agnès Le Gac, Helena P. Melo, Sara Valadas, Ana M. Cardoso and António Candeias
15:40-16:00	Coffee break
16-16:20	**24.** *Traditional and modern colours in Gino Severini's murals.* Patrizia Moretti, Stefan Zumbühl and Francesca Piqué
16:20-16:40	**25.** *Solid state NMR depth profiling and spectroscopy of paint layers in support of the conservation of a white sculptural environment by Louise Nevelson.* Pierre Taugeron, Sullivan Bricaud, Cindie Kehlet and Jens Dittmer
16:40-17:00	**26.** *Unveiling a World of Dreams: A Multi-Technical Analysis of The Pink Bows (1937) by Paul Delvaux.* Eveline Vandeputte, Geert van der Snickt and Nina Deleu
17:00-17:20	**27.** *Colonization of stones: Raman spectroscopy of microbial pigments, from rock outcrops to monuments.* Jan Jehlička, Adam Culka, Peter Vandenabeele, Danilo Bersani and António Candeias
17:20-17:40	**28.** *Macro-Raman mapping: a novel approach in the analysis of art objects* Anastasia Rousak and Peter Vandenabeele
17:40-18h10	**Plenary lecturer 4** *David Alfaro Siqueiros in Los Angeles, 1932* Leslie Rainier
18:10:19:10	**Workshop on micro fading tets (MFT)** Tomasz Łojewski

DAY 3 - Friday, 16 September

09:00-09:30	**Plenary Lecturer 5** *The conservator-restorer and the Street Art: the questions are on the table. The Valencian Old City Case.* Mercedes Sánchez-Pons
Session 5: Challenges for conservation-restoration	
09:30-09:50	**29.** *A new challenge for the restoration of chromatic identity of the M'zab Valley, Algeria.* Yacine Gouaich and Antónia Fialho Conde
9:50-10:10	**30.** *Colour in Modern Architecture of Olivetti's Town.* Enrico Giacopelli and Marco Zerbinatti
10:10-10:40	Coffee break and poster session
10:40-11:00	**31.** *Street art and cultural heritage. Conceptual issues and operational choises.* Maria Vitiello
11:00-11:20	**32.** *The color and rehabilitation of architectural surfaces as heritage value and its contribution to the image of historical cities: the case of the National Theatre of São Carlos.* Andreia Santos, João Pernão and José Aguiar
11:20-11:45	Closing session
12:00:13:30	Lunch
14:00-17:00	Guiding visit to Almada Negreiro's Mural paintings at the Maritime Stations of Lisbon.

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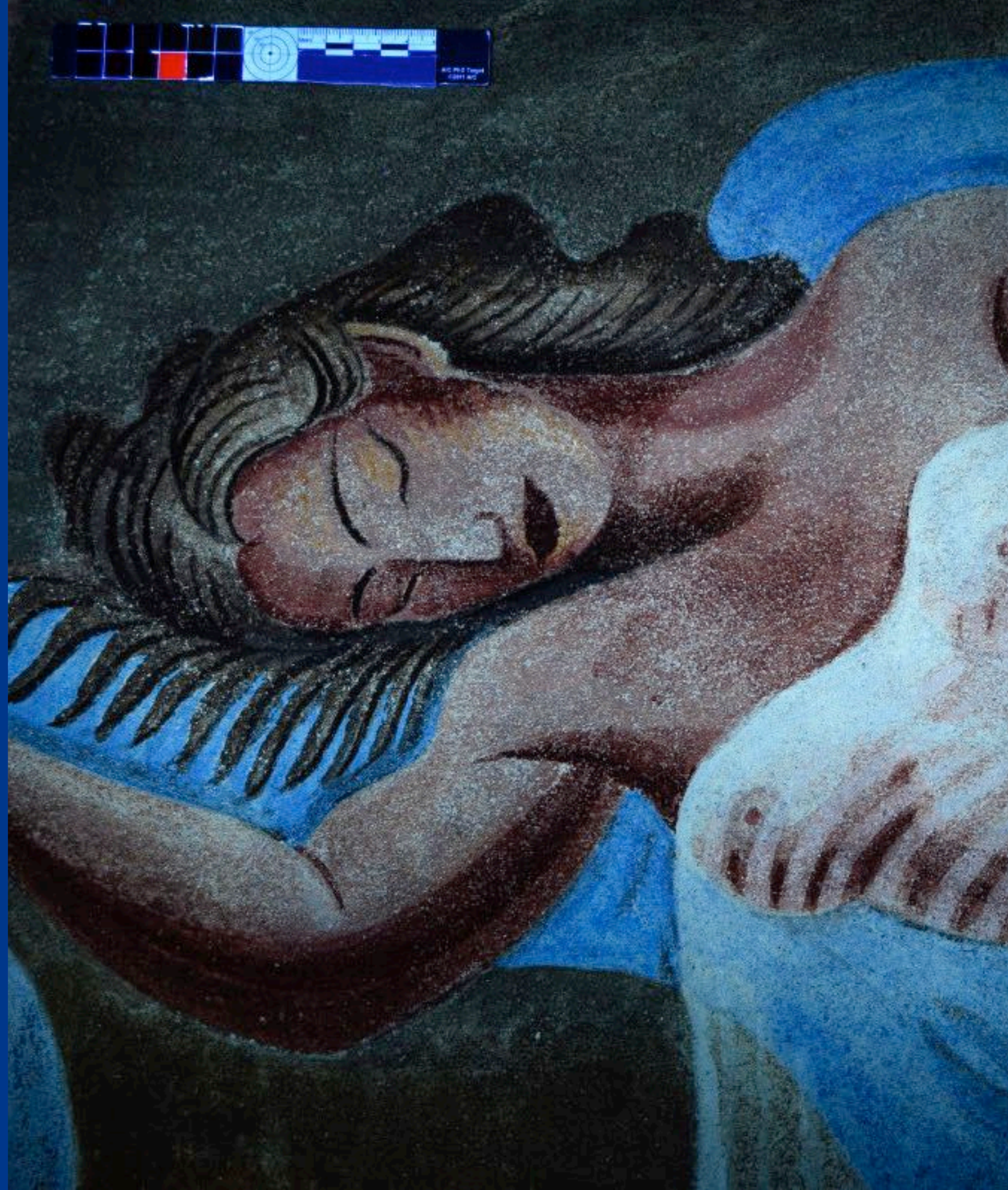
MONDERN AND
CONTEMPORARY ART

PLENARY LECTURERS



Technical Photography. 1939 Mural painting detail by Almada Negreiros at DN Building, Lisbon.
Image credits: M. Ribeiro-Project ALMADA ©All rights reserved.

Almada Negreiros work under, for and about the Portuguese dictatorship of the Estado Novo

Mariana Pinto dos Santos[1]

[1] Instituto de História da Arte - FCSH, Universidade NOVA de Lisboa, Portugal

The emergence of the Estado Novo (New State) in 1933, a dictatorial state of fascist orientation, was a turning point in Portugal in all areas, including artistic production. A new conjuncture altered the working conditions in the arts, which were called upon to collaborate in the animation, staging and propaganda of the nation. The Estado Novo put into practice a policy of public building construction, in an effort to modernise the country's image similar to that of other dictatorial regimes in the 20th century. The paid work that the artists would do would mainly be in the service of the State in the decoration of these buildings. It was in this context that pictorial programmes of mural painting, incised drawing, stained glass, tiles and tapestry were produced by artists in public buildings and for national and international exhibitions. Some of them also worked in the graphic arts, which were fundamental for nationalist advertising. Artistic creation during the dictatorship was marked by the constraints of commissioning by the State. There were, however, pockets of resistance, both by opposition artists and by artists who sought, in the context of the dictatorship, to forge conditions for modern art.

In this presentation I will discuss the work of Almada Negreiros in the context of commissions, particularly the work he carried out during the Estado Novo period. I will analyse the constraints on artistic production and the possibilities of pursuing the modernist project in Almada's mural paintings as well as the implications of his use of colour in an anti-naturalistic way. I will also approach the theoretical issues raised by the relationship between art and the state under dictatorship.

Mariana Pinto dos Santos, art historian and independent curator, holds a PhD in History and Theory from the Facultat de Belles Arts - Universitat de Barcelona.

She is an integrated researcher at the Institute of Art History, NOVA FCSH, where she coordinates the Theory of Art, Historiography and Criticism Group. She is co-editor of the Literary Work of Almada Negreiros. She curated, among others, the exhibition José de Almada Negreiros: a way of being modern, Fundação Calouste Gulbenkian, Lisbon (2017). She is co-responsible for the research project Iberian Modernisms and the Primitivist Imaginary ((2018-22) (PTDC / ART-HIS / 29837/2017). She is editor at Edições do Saguão.

What We Can Learn from Each Other

Katherine Schilling[1]

[1] Department of Chemical Engineering, Yale University, New Haven, CT 06511

One of the most basic biological senses is the ability to differentiate nutrient concentration differences [1]. Another early and crucial sense is distinguishing light from darkness. Organisms then became able to resolve wavelengths of visible light and intensities. We see color because it helps us survive, and it is also a source of delight, learning, and wonderment. Color is a crucial sense by which creatures experience the world around them; it is a sophisticated way to interpret information encoded about the way that light interacts with matter. Returning to the origin of color is important to contemplating possibilities for what information we are gathering by viewing and measuring color.

One piece of information from color is that something has changed. In photograph conservation, unwanted pink, orange, and yellow coloration can develop in silver-gelatin black-and-white photographs [2]. This spontaneous pigment formation transforms the photograph into something altered by time and its environment, altering the original message of the artist. A fundamental model, backed by experimentation and analysis, is yet to be developed. Recent research outside conservation has demonstrated the role of the gelatin in creating nanoparticle clusters of varying sizes and color, which has not been discussed in conservation literature [3]. Significant knowledge resides in literature outside conservation to further illumine this new, if undesirable, pigment formation. This talk will use this case study to explore the changing nature of artists' materials, the complex environment within a photograph, the production of color by nanoparticle pigments, and the interdisciplinary engagement that moves conservation forward.

References

[1] P. Godfrey-Smith. "Other Minds". Farrar, Straus and Giroux, 2017.

[2] G. Weaver. "A Guide to Fiber-base Gelating Silver Print Condition and Deterioration". George Eastman House, 2008.

[3] P. Bhola, M. Mohanty, P. S. Mohanty, Journal of Molecular Liquids 325, 2021, 115135.

Dr. **Katherine Schilling** is an associate research scientist and lecturer based out of the department of Chemical & Environmental Engineering at Yale, and works within the Institute for the Preservation of Cultural Heritage in the Applied Research and Outreach group. As the bridge between the School of Engineering & Applied Science and the Yale collections, she also creates coursework, research, and extracurricular opportunities for Yale undergraduate students to engage with the collections from a scientific and engineering perspective. She regularly teaches the Materials Science of Art and Being Human in STEM. She earned her doctorate in 2015 from the California Institute of Technology in chemical physics.

Children's Games - A large painting by Candido Portinari at Gustavo Capanema Palace – RJ, Brazil

Claudia Nunes[1,2], Carolina Barata[1,3],Maria Aguiar[1], Roberto Carlos da Conceição Ribeiro[4], Rosana Elisa Coppedê Silva[4], Caroline Martins de Souza[4] and Michelle Teixeira Cassiano[4]

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This work aims to elaborate a scientific and conservation study of the works performed by Candido Portinari for the Gustavo Capanema Palace, built at the beginning of the 20th century, in the period between 1937 and 1943. The building was built to be the headquarter of the Ministry of Education and Health. Originally, the architectural project was not thought to receive ornamentation because it is a modern architecture project. However, at the insistence of Oscar Niemayer, the Minister of Education and Health - Gustavo Capanema decides to hire Candido Portinari, a young artist just arrived from Europe, where he spent three years developing his artistic knowledge. Specifically in this article we will focus on the Children's Games panel, executed in 1945, two years after the inauguration of the building. Being one of the first large works performed by the artist and one of the most inspiring to be admired, it is possible to identify several children's games, such as, blind goat, put the tail on the donkey, seesaw, rotate top, hats folded newspaper hats soldiers, sock balls, among others.

Colorimetry and X-ray fluorescence analyses were used to characterize pigments and mortar that compose the work, the results of which aim to determine the materials and technique used by the artist as parameters for the elaboration of conservative and restoration guidelines.

Painel "Jogos Infantis", na técnica de tempera, pintado em 1944, medindo 4.77mx 12.95 m. Autor desconhecido. Arquivo Iphan-RJ ©All rights reserved

Claudia Nunes é Chefe do Setor de Bens Móveis e Integrados do IPHAN no Rio de Janeiro, atuando como Consultora e Fiscal de Cons. e Restauração de Bens Móveis Integrados para acervos e monumentos tombados, cuidando também da restauração de centros históricos como Paraty, e atuando como parecerista para Projetos PRONAC, fiscaliza as obras de restauro do Museu Nacional e é responsável pela orientação do restauro das obras artísticas do Palácio Gustavo Capanema. Além de ter vários trabalhos publicados, ministrou cursos na Fundação Joaquim Nabuco/RE, Projeto faz Cultura /Caixa Cultural de Salvador/BA e Associação ArcoIt/Curitiba/PR. Claudia é doutoranda no Curso de Doutoramento em Conservação e Restauração de Bens Móveis Culturais na Universidade Católica do Porto, Portugal e membro do CITAR – Centro de Investigação Tecnológica e das Artes, e professora no Centro Técnico de Restauro Templo da Arte em São Paulo.

David Alfaro Siqueiros in Los Angeles, 1932

Leslie Rainer[1]

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In 1932, David Alfaro Siqueiros, renowned Mexican muralist, painted three large-scale exterior murals in Los Angeles: Street Meeting, América Tropical, and Portrait of Mexico Today. These three murals exemplify this period of time in the artist's life and work as he experimented with modern materials and technologies; advanced the art of mural painting in the United States; and worked in different contexts. During his stay in Los Angeles, he wrote extensively on mural painting, how muralism related to his political views, and the revolutionary techniques he was developing.[1]

This presentation will discuss the materials and techniques used by Siqueiros to paint these murals, and the conservation history of each, with a focus on the project to conserve, protect, present and interpret América Tropical. This comprehensive project, led by the Getty Conservation Institute and El Pueblo de Los Angeles Historical Monument of the City of Los Angeles, included the conservation of the mural, construction of a protective shelter and viewing platform, and the installation of an interpretive center.

These three murals by Siqueiros were, in many ways the origin of the modern mural movement in Los Angeles, and the conservation challenges they face can be compared with conservation issues of many modern murals today.

Image caption: América Tropical, David Alfaro Siqueiros, 1932, after conservation treatment and construction of a protective canopy shelter. Photo © J. Paul Getty Trust, 2012. Mural © 2020 Artists Rights Society (ARS), New York / SOMAAP, Mexico City.

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Image: Leslie Rainier at work in the mural painting American tropical, Los Angeles. Getty ©All rights reserved

Leslie Rainer is a wall paintings conservator and senior project specialist at the Getty Conservation Institute, carrying out a variety of projects addressing decorated architectural surfaces. She has worked on projects in Africa, Europe, China, Central and South America and Los Angeles, where she has worked with GCI, the City, and other conservators on a number of public murals. Leslie received a Master's Degree in the Conservation of Decorated Architectural Surfaces from Antioch University, a certificate in mural paintings conservation from ICCROM, and the Rome Prize in Historic Preservation and Conservation from the American Academy in Rome. She is a member of AIC, IIC, ICOM-CC, and WAAC. She has organized symposia with the GCI, and acted as volume editor for their proceedings.

The conservator-restorer and the Street Art: the questions are on the table. The Valencian Old City Case

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Valencia is a reference point for urban art and in its old city, with Spanish cultural legal protection since 1993, there is an extensive and heterogeneous production, which coexists with monuments from the different civilizations that have populated the city over the centuries of its existence. Interventions by internationally renowned artists, such as Escif, Blu, PichiAvo, Fasim, Hyuro or Julieta, together with pieces by other local and foreign artists, born with different motivations and expectations, have become the focus of attention for the city's inhabitants and visitors, while their fate remains uncertain.

For some years now, there has been a growing social, academic and even economic and institutional interest in this cultural phenomenon, which has led to a debate on whether, in some cases, the option of considering them as cultural heritage and therefore their conservation could be considered, but... for how long? Who would be responsible for making the decision? What can or should be conserved, a specific piece or the fact that they continue to be produced? The conservation and restoration professional must decide what role he or she wants to take in these processes, both in the dissemination of the understanding of this cultural phenomenon and the ethical possibilities of intervention on it, as well as in the enormous technical difficulties involved in the conservation of its material reality.

Blu and Escif interventions in *Plaza del Tossal,* Valencia, in 2011, and 2022.

Mercedes Sanchéz Pons has a PhD from the Universitat Politécnica de Valencia (2002, Conservation and Restoration of Cultural Heritage Program). Since 2003 she has been a lecturer in the Department of Conservation and Restoration of Cultural Heritage of the UPV in bachelor and master's degrees, where she has been teaching conservation and restoration of mural paintings, particularly contemporary murals and urban art, since 2006.

She is a member of the research group "Workshop on Analysis and Intervention in Mural Paintings" of the Instituto Universitario de Restauración del Patrimonio of the UPV and belongs to the Micro-Research Cluster (MCI) "Globalization, Tourism and Heritage" at the International Campus of Excellence VLC/CAMPUS. She is also a member of the "Urban and Public Art" group of the Ge-IIC.

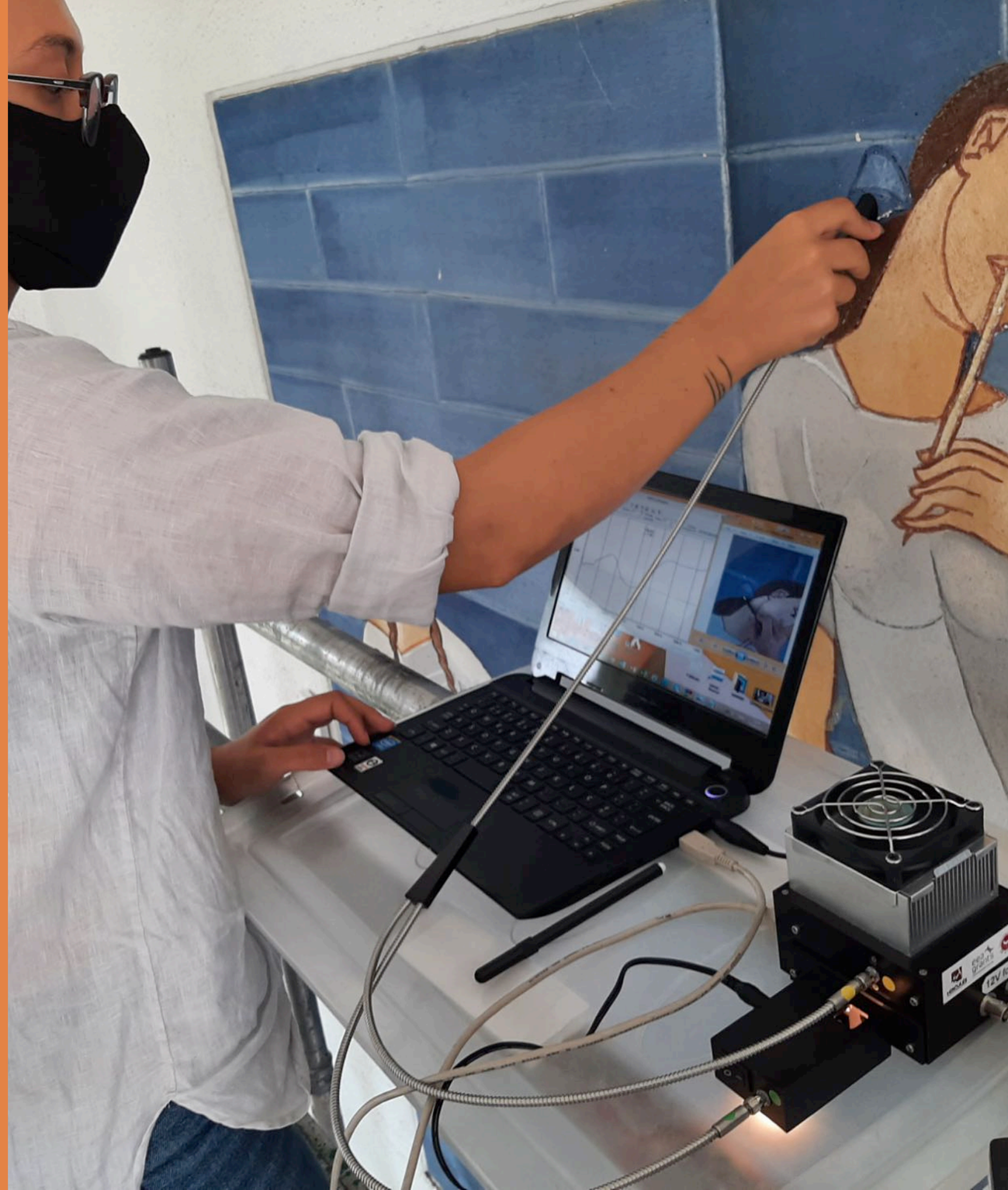
She has directed and has been involved in numerous researches, cataloguing and intervention projects, about national and international mural paintings. Among the most recent ones, the restoration of the murals of the church of San Nicolás in Valencia and the European Project Ewaglos: european illustrated glossary of conservation terms for wall painting and architectural surfaces. She is also co-editor and author of the volume Conservation Issues in Modern and Contemporary Murals (Cambridge Scholars Publishing, 2015).

colours 22

MONDERN AND
CONTEMPORARY ART

Session 1

COLOUR HISTORY AND SYMBOLISM IN THE 20 AND 21TH CENTURIES



FORS analysis. 1956 Mural painting detail by Almada Negreiros at Escola BE Patricio Prazeres, Lisbon.
Image credits: M.Gil-Project ALMADA ©All rights reserved.

01_ On the study of Porto's murals (1930-1970): state o the art and preliminary results

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Between 1930 and 1970, during the dictatorial period known as the Estado Novo, art had a modernist expression and aesthetic, representing various themes. Throughout the city of Porto, important fresco and marmorite murals were executed in its public and private spaces, commissioned by key artists such as Dordio Gomes [1].

It's well known that he taught fresco painting technique at the School of Fine Arts of Porto and praised the technique's classical guidelines [2].

However, recent studies have shown that 20th-century practice was not always governed by theory. There was room for experimentation [3-5].

Therefore, we intend to highlight the state of the art concerning the study of Porto's murals, to contribute to the understanding of 20th-century artistic practices in this city. The resulting conclusions may help create the scientific bases necessary for future conservation and restoration treatments, as well for a new approach to a new management involving the community that could include a citizen science project.

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02_ Decoding a drawing: Igreja de Nossa Senhora de Fátima glassworks colour scheme

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In the process of cataloguing the modernist Almada Negreiros' estate, many preparatory drawings for several of the author's public artworks are currently being identified. The volume and complexity of his prolific activity means that sometimes it is hard to connect specific documents and artworks of research and preparation to the respective final works. Recently, one particular drawing proved to be the key for understanding several other documents, simultaneously contributing to clarify the artist's methodology when preparing for the large-scale glassworks of the Igreja de Nossa Senhora de Fátima. This article presents these new advances.

Image source: Detail of Almada Negreiros' drawing (ANSA-A-980 in www.modernismo.pt)

Acknowledgments

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03_ Colours, inspiration, and history behind Gilda Newberger

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Gilda Neuberger's (GN) oeuvre establishes a dialogue between colours and shapes. Such an artistic sensibility was found above all in her paintings with the millenary technique of the fresco, whose colourful creations have an attractive visual impact on their observers.

GN was an accomplished Brazilian artist. She was born in 1911 in São Paulo, Brazil, to two Italian immigrants. Early on, GN showed artistic talents through exceptional drawing skills while very young. Thus, she decided to focus her attention there, pursuing an artistic career. At age 22 (1933), she attended the National Academy of Fine Arts in Rio de Janeiro, Brazil; here, she learned the techniques of oil, gouache, watercolour and acrylic painting on paper media. In 1936, she became the pupil of Candido Portinari (1903-1962), a leading member of Brazilian Modernism, who also introduced her to the fresco painting. After becoming a qualified artist, GN earned several awards, two of which were the Silver and Bronze Medals in General and Modern art from the National Museum of Fine Arts [1].

The following years saw a growing involvement of GN's in fresco painting: one of the occasions expressing such an engagement occurred in 1963, when she created her hugest fresco work on wall support, the "Homenagem aos trabalhadores", in a scenario of appropriation of external reality in a sensitive and inspired way of the daily proletarian life in the Ciferal factory of Rio de Janeiro-BR. Later, in 1980, this painting was recognized as a local Cultural Heritage according to the Cultural Agency of Rio de Janeiro State. Another crucial moment of GN's involvement in fresco painting occurred when she visited the Venice Biennale in 1982, where, under the mastery of Bruno Saetti (1902-1984), professor at the Academy of Fine Arts in Venice [2], GN learned the technique of fresco on canvas. Moreover, GN was a strong advocate of fresco painting in Brazil besides a controversial painting technique, the false fresco.

Aiming to study the production and artistic path of GN through the existing documentation, an online survey on existing documentation in the artist's family estate, Biblioteca da Escola de Belas Artes da UFRJ, Museu Dom João VI da UFRJ, was carried out, and an interview with her daughter Hilda Neuberger.

Despite the significant technical range and diversified artistic path, which touched both Brazilian Modernism and Contemporanism, there are no published studies on GN works. To overcome the lack of knowledge and recognition that GN's life and work deserve, an ongoing PhD work attempts to shed light on these topics. Thie study comprises the scientific analysis of a selection of her representative works to unveil the modus operandi she used to create fresco and false fresco paintings. Moreover, this research looks at her coloured palette with special attention. The outputs from the first phases are the topic of the proposed poster.

Acknowledgments

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colours 22

MONDERN AND
CONTEMPORARY ART

Session 2

OLD AND NEW COLOUR MATERIALS AND THEIR ORIGIN/MANUFACTURE/USES

h-OM analysis. 1945 Mural painting detail by Almada Negreiros at the Maritime Station of Alcantâra, Lisbon.
Image credits: M.Gil-Project ALMADA ©All rights reserved.

04_ Madder lakes; Reproduction of recipes, chromatic variation and denominations

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The birth and application of lakes pigments is originally related to the natural dyes[1] most commonly used in the dyeing processes of textiles and leather. The lakes constitute a special group of pigments due to the great chromatic variety they present. A unique case is found in the *Rubia tinctorum. L.*, starting from the same raw material, it is possible to obtain lakes pigments that cover a wide chromatic range, such as *Turkish red*, *garanza pink* or *rosseto de Paris*, passing through chromatic ranges that include orange or brown pigments such as those called *Brunette*, or even pigments similar to cochineal lakes, called *carmines de garanza*. This wide chromatic variety is due to various factors, such as the plant's growth cycle, the growing soil, etc. [1,2]. The amount of precursor substances of the dyes present in the root [5,6], but also the manufacturing process followed to obtain the desired lakes pigment plays an important role [5,6].

Therefore, it's all important to understand not only the historical context, but also the degradation processes in which they are involved, so in this research, we have carried out the reproduction in the laboratory of a series of historical recipes [4,7], corresponding to different periods and which present variations both in the components and in the process of obtaining them. A review of retrospective sources was carried out, to find out the different names attributed to madder lakes pigments, which in many cases refers to the colour.

Fig.1. Recreation of a Madder lake according to the procedure written by Marcucci in the work Saggio analitico chimico.1816.

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05_ Sustainable Glasses for Art and Design

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Glass is an attractive material with unique characteristics such as transparency, translucency, brightness, and versatility. The glass sector is known for the high quality of products and technological innovation. It covers several of our daily life objects with many advantages over other materials, such as high durability and a high degree of recyclability. They can be developed from inexpensive raw materials such as silicates and oxides, making glass an optimal solution to reach a more sustainable future. Even the European Commission has declared a stated aim to enhance the glass industry's competitiveness. Still, the glass production processes yield environmental issues that need to be solved, including energy consumption and expensive and critical pigments used to obtain coloured or luminescent glasses.

Current research at the research unit VICARTE (Glass and Ceramic for the Arts) aims to develop and engineer sustainable and low-environmental impact glasses, along with coatings and surface functionalisation, not only for light applications but also for light applications art and design. Different strategies are being explored as (I) developing new enabling technologies providing new surface functionality, (II) replacing elements on the EU Critical Raw Materials list that are commonly used to obtain coloured and luminescent glasses, (III) sourcing glass colourants and glass constituents from wastes as by incorporating sludge with high alumina and calcium content produced by Water Treatment Plants from EPAL, which are sources of various oxides and compounds of importance for glass forming. This pioneering research on the development and use of sustainable glasses allows the exchange of know-how between artists, designers, scientists and industry, giving rise to innovative sustainable glass materials with novel optical properties.

06_ Andy Warhol and His Amazing Technicolor Shoes: Characterizing Early Synthetic Dyes used in *À la recherche du shoe perdu* and Dr. Ph. Martin's Radiant Concentrated Watercolors

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Early synthetic dyes are extremely light fugitive and omnipresent in many museum collections, therefore identifying their components is of universal interest. [1,2] Synthetic dyes were extensively by artists in the first half of the 20th century, knowingly or otherwise. This included Andy Warhol and his *À la recherche du shoe perdu* (1955), a major portfolio of hand-colored prints, a copy of which lies in the collection of The Museum of Modern Art (MoMA). This collection of prints was used as case study for developing a systematic and non-invasive identification of the dyes used in its execution. It is known that Warhol and friends used Dr. Ph. Martin's Radiant Concentrated Watercolors to color these prints [3], and to better characterize those dyes, the prints were first analyzed using visible reflectance spectrophotometry to determine the absorbance maxima associated with various dye species.

A historical set of Dr. Ph. Martin′s Radiant Concentrated Watercolors were then analyzed by UV-Visible spectroscopy which provided confirmation of some major dye species in the historical set, and come colorants appeared to contain mixtures. These include Acid Orange 7, Azocarmine B, Rhodamine B, Mauveine, Tartrazine, Patent Blue V, Napthol Green B, Acid Fuchsin, Eosin A, Acid Red 73, Acid Blue 22, and Malachite Green. The data from the historic set was subsequently used for direct comparison with Kubelka-Munk converted reflectance spectra from the Warhol portfolio using principal component analysis (PCA). Sample from the historic set were also characterized u-Fourier transform infra-red spectroscopy, Raman spectroscopy, and surface enhanced Raman spectroscopy (SERS) to confirm the results of UV-Vis analysis via fingerprint identification. To better elucidate the nature of mixtures present, thin layer chromatography (TLC) was exploited to better separate the components of each colorant. This was coupled with a portable SERS and visible reflectance spectroscopy to provide further insight into the number of dyes present in each colorant.

Overall, analysis of the historic set of Dr. Ph. Martin′s Radiant Concentrated Watercolors provided further insight into the dyes use in *À la recherche du shoe perdu* and confirmed their extreme light sensitivity.

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07_ Complementary study of 27 paintings from MUNCH collection using MFT and pXRF techniques

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A selection of twenty seven paintings from the collection of MUNCH museum in Oslo have been investigated in a campaign in February 2020 that made use of MFT (microfading tests) and pXRF (portable X-ray Fluorescence). The study aimed to get an overview of main colours subject to light-induced change with the purpose to establish a categorization of the paintings according their light sensitive characteristics. These paintings were included in the long-term exhibition program at the museum.

Microfaedometry is a technique that allows to obtain data for determining the dose of light that is safe for the studied object [1]. The measurement consists in irradiating a selected point on an object with high-intensity (up to 10Mlx) white light and simultaneous registration of colour changes caused by this illumination. The size of the measurement point (0.6 mm) is so small that the induced colour changes are not visible to the human eye (our sensitivity to the differences in shades depends on the size of the observed field) and thus could be regarded as non-destructive. A single micro fading test (MFT) takes up to 10 minutes and several measurements are usually performed for selected hues present on an object.

Each area measured with MFT was also analyzed by pXRF to obtain a compositional map of each object. Through elemental characterization pXRF allows to make pigment attribution for each color or mixture of colors.

Collecting data through MFT has been very valuable tool for confirming or affirming former assumptions regarding lightfastness of certain painting materials in the collection (e.g. darkening of red areas containing vermillion or fading of yellow colours containing Cd yellow). Though the process of degradation is continuous, it can be slowed down by reducing exposure to light.

The presentation will thus discuss the results from this campaign and also critically show hypotheses for display according to the sensitivity of these paintings to light [2]. The data interpretation can support the fact-based preservation policy for these highly valuable artworks.

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08_ Non-destructive analysis of the early Isolani Collection at Pratt Institute

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[5] The Phillips Collection, Washington DC

The early Isolani collection, donated by the late artist to Pratt Institute in 2015, is composed of twenty paintings and ten fiberglass polyester resin sculptures dating from 1957 to 1969. Both paintings and sculptures show the artist's exploration of materials and their interaction with light as the main theme of the artists' early work. To investigate Isolani's materials and techniques and their evolution with time, non-destructive scientific analysis was performed on several paintings and sculptures through the use of portable instrumentation, namely X-Ray Fluorescence, X-ray Fluorescence Mapping (MA-XRF), External Reflectance Fourier Transformed Infrared Spectroscopy (FTIR), Raman spectroscopy and Nuclear Magnetic Resonance (NMR). The results revealed that the artist had a unique painting palette involving mainly ground metals (eg. Copper, Aluminum, Zinc, Tin, Lead, and Gold) on acrylic and alkyd coatings. In addition, the unusual presence of high amounts of Chlorine in most of his paintings strongly suggests the use of chlorinated rubber resin. Two of Isolani's fiberglass polyester resin painting sculptures were also analyzed. The results show that the artist achieved intentional transparency vs opacity effects on the sculptures by "color-matching" red lead and red organic dyes. Areas of high opacity also show both the presence high-density fiberglass suggested by high intensity of Silicon and Calcium in the XRF analysis, whereas transparent areas are mainly composed of red-dyed polyester resin and low-density fiberglass (low Silicon and Calcium signals). This preliminary study through the use of portable instrumentation showed the complexity and richness of Isolani's materials and techniques and his experimentation of "new materials" in both his paintings and sculptures.

09_ Dartecor – Handmade Colors

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Dartecor is a brand that produces handmade artistic paints and accessories, focused on the Premium range and on offering artists the best product so that their art works obtain the longest possible lifespan.

This presentation has as main objectives to show the environment and the production processes of how colors are created, the importance of training in Conservation and Restoration in the development of the project, on the way of thinking and selection of raw materials and raising reflections on all this work that may be the object of study by researchers in the future.

colours 22

MONDERN AND
CONTEMPORARY ART

Session 3

COLOUR DETERIORATION (ORIGIN, TYPES, MECHANISMS)

Technical Photography. 1945 Mural painting detail by Almada Negreiros at the Maritime Station of Alcantâra, Lisbon.

10_ Degradation of pigments in street murals: *in-situ* and laboratory Raman studies.

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Important fading and degradation phenomena are visible in the street murals painted by the Italian-Spanish collective Proyecto Ritual in 2010 on the external walls of the Cooperative Popular Houses of Mancasale and Coviolo in Reggio Emilia (Italy).

The artworks have been mostly realized with commercial spray paintings, modern synthetic materials usually lacking of long-last stability. In addition, the exposure to the outdoor environment including sunlight, rain, temperature changes, pollution accelerated their deterioration leading to visible effects after a very short period after their realization. For that reason, they have been included in a study campaign in the frame of the European project "Conservation of Art in Public Spaces" (CAPuS), designed to study artworks of contemporary public art, including murals and outdoor sculptures, co-funded by the ERASMUS+ Knowledge Alliances 2018-2021 programme.

The present work is about the Raman analysis of the paint materials, in particular pigments and dyes and their degradation, present on four murals: "The Big Mother" by Gola Hundun, "Big Sacral Bird" by Kenor, "Oriental Carpet" by H101 and "The Economy Subdues You" by Zosen.

The first phase of the Raman investigation was performed on-site, with the aim of identify the whole palette. Three different mobile Raman spectrometers were used, operating at different wavelengths, in order to minimize fluorescence effects and to maximize resonance enhancements: a Bruker Bravo (785-853 nm), a BWTek i-Raman® EX (1064 nm) and a EnSpectr RaPort (532 nm). The measurements have been carried out using a mobile scaffold mounted on a truck.

The second phase, mostly dedicate to understand the mechanisms responsible for the fading of the colours, was realized using a micro-Raman apparatus (Horiba Labram) on millimetric samples taken from the surface of the paintings and on their cross sections.

The gray-whitish aspect of some colours is mostly due to the concentration of rutile on the outer surface of the paintings. Two possible mechanisms involving the photo-degradation of the dyes and the migration of rutile from the inner layers are discussed.

Acknowledgments

This work was supported by the project "Conservation of Art in Public Spaces (CAPuS)", funded by the European Commission, Programme Erasmus Plus. A. R. greatly acknowledges the special research fund of Ghent University, for her postdoctoral fellowship (Ghent University-BOF).

11_ Acrylic colours for peace: study and conservation of an outdoor mural painting

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At the end of 2021, the project for the study and conservation of the mural *La técnica al servicio de la paz* (1952) by the contemporary artist Federico Silva (Ciudad de México, 1923-) began with the conservation diagnosis through technical studies based on the methodology and the experience of the research projects of contemporary mural paintings abroad [1]; as well as an adequate conservation proposal to resolve the stability of the painting, which has altered its perception, form and meaning, as a consequence of the behavior of acrylic paint in the face of the different effects of the outdoor environment [2].

La técnica al servicio de la paz is the first outdoor mural painting by Federico Silva, commissioned for the Higher School of Engineering and Architecture of the National Polytechnic Institute (ESIA-IPN), at the north of Mexico City. After this research, today we know that the challenge of painting outdoors implied for this artist and his time a change of meaning and materiality, since his predecessors had made works indoors and mostly with the fresco technique [3]. It was thus that the south façade of the functionalist building served as a base and location to echo the creation of a public art, with a strong political charge and a denunciation of the historical moment: war and the use of nuclear energy and its consequence for the nations [4].

Federico Silva′s mural painting consists of acrylic painting and flattened cement, made by incisions for the geometric figures and charcoal strokes for the human forms. The colour palette, mostly composed of complementary tones such as green, purple, orange and pink, contrasts with primary colors such as blue and yellow, as well as white and black to accentuate the lines of the forms [5].This work is part of the first results of the formulation and patent of acrylic paint and its use in mural paintings, as well as the work between science and art to produce a paint resistant to the passage of time and weather. This formulation is known as Politec® [6], it was developed and patented by José Gutiérrez, director of the *Research Studio in Painting Materials and Experimental Techniques*, IPN, between 1945 and 1956, commanded by the politician Jaime Torres Bodet and the committee made up of the artists Diego Rivera, José Clemente Orozco and David Alfaro Siqueiros.

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12_ Colours of modernism in Edvard Munch's paintings from Warnemünde period

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A selection of five paintings from the collection of MUNCH museum in Oslo: *Canal in Warnemünde* (1908), *Old man in Warnemünde* (1907), *Worker and Child* (1907), *The Drowned Boy* (1907/1908) and *Women on the Bridge* (1904/24) have been investigated using the MOLAB facility of the European Research Infrastructure IPERION HS and ERIHS [1]. The study aimed to characterize the Munch's paint materials in the framework of modern European painting manufactures at the turn of centuries.

The MOLAB approach consisted of a multimodal analytical strategy based on the combination of several state of the art noninvasive and portable methodologies covering the wide spectral range from X-ray to mid-IR [2]. All the five paintings were fully scanned by elemental, vibrational and electronic hyperspectral spectroscopies. Noncontact FT-IR in reflection mode enabled the identification primarily of an oil painting technique with the additional presence for some paints of wax and protein-based binders whose spatial distribution has been achieved by the hyperspectral imaging exploring the SWIR window [3]. The XRD mobile scanner permitted the identification of crystalline components in 80 spot measurements and their localization by performing mapping on 5 different areas (10x15cm2).

MA-XRF correlation maps of cadmium and selenium integrated by vis-NIR hyperspectral fluorescence revealed the use of cadmium sulfoselenide pigments in *Women on the Bridge* suggesting the year 1924 for the painting execution. Interestingly, cadmium sulfoselenide was also detected in *Canal in Warnemünde* dated 1908, unveiling an early example of use of Se-containing CdS [4].

Principal Component Analysis-PCA and Spectral Correlation Mapper- SCM, applied to VIS-NIR multispectral imaging and presented as colour composite images (in trichromatic modality), revealed further clues of Munch's artistic technique (e.g. the use of Thénard's and ultramarine blue as separate unmixed paints both for the contouring line of the figures and the larger blue painted areas).

Findings from this study are expected to bring also more knowledge on the undesired behavior of certain oil paints used by Edvard Munch and his contemporaries.

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13_ Study of influence of zinc white pigment in Aurélia de Sousa self-portraits

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Zinc white pigment played an important role for painters as an alternative pigment to the toxic lead white since around 1840 and the middle of the 20th century. Recent studies revealed relevant drawbacks that raised major concerns regarding the conservation of paintings [1]. Zinc white has a great ability to form metal soaps with binders and varnishes that can lead to eruptions through the paint layers, weakening and detaching it, causing surface 'blooming' or decreasing opacity [2]. The formation of metal soaps occurs by reactivity of the cations from the zinc oxide pigment with the fatty acids of the drying oils [3] or with the terpenic acids from natural resins [2]. Although drying oils were the prevailing binders at that time, painting methods could include mixtures with varnishes based on natural resins to produce oleo-resinous binders or the use of complex structured layers based on intermediate varnishes, isolation of specific pigments with varnish and application of final varnish coatings [4]. Besides deterioration caused by formation of metal soaps, the degradation products from drying oils and natural resins, together with the metal oxalates will affect the removability of varnishes and the cleaning process [2].

Aurélia de Sousa was a painter that lived between 1866 and 1922 and who was considered the first female Portuguese painter by José Augusto-França [5] in recognition of her modern aesthetic and total commitment to art. One of her most known self-portraits where she represented herself as a saint Franciscan, S. António and belonging to Museu da Cidade do Porto, presented small areas of surface "blooming". Surface examination with UV radiation revealed a yellowish-milk fluorescence common to natural resins and a rather orientated application. The non-homogenous varnish layer has orientated brushstrokes that accompanies some of the shape contours or superimposes specific oil paint brushstrokes. Such purposed-orientation and the individual characteristics of brushstrokes suggest making part of her original pictorial technique. A previous study [6] by X-ray fluorescence spectrometry of such painting revealed an extensive use of zinc white, similarly to others.

The current proposal has three aims – the first intends to verify the possible correlation between blooming occurrence and the degradation of zinc white pigment within the binder/varnish influence; the second, to characterize the artist pictorial technique within the contemporary artistic context and the third, to set analytical methodology for similar cases. To achieve such goals, it is proposed to carry on μ-Raman to verify the presence of zinc white on ground and paint layers; and μ-FTIR analyses for the identification of the binder and varnish, their degradation products and of zinc white pigment.

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14_ An Insight into the Green Deteriorated Paint Layers at the Maritime Station of Alcântara (Lisbon): an Archeometric Study

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The present case study addresses one of the most emblematic mural paintings set painted in 1945 by the Portuguese artist Almada Negreiros at the Maritime Station of Alcântara, Lisbon. In total, they are eight monumental murals depicting Portuguese culture and history. The paintings were made with a bright chromatic palette which today display different states of conservation. The green paint layers are particularly damaged, showing visible severe flacking and powdering in the lightest shades. The goal of this research is to understand the decay phenomenon by identifying the pigments, the painting technique, and the external deterioration factors. These data will form the basis for the future safeguard of these mural paintings.

The analytical setup comprises in-situ technical photography in the visible, ultraviolet (UVF) and infrared radiation (NIR), h-OM, h-EDXRF, colorimetry and spectrophotometry. For comparison, the analyses were carried out on stable and deteriorated green paint layers. Microsamples of selected paint layers were also collected for laboratory analyses (OM, SEM-EDS, μ-XRD, μ-FT-IR, and micro-Raman spectroscopy).

Fig1: Detail of the deteriorated green paint layers found in P5. Maritime Station of Alcantara, Lisbon. Photo by: MGil2021

Acknowledgements

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15_ Preleminary diagnostic Survey of Deteriorated Paint Layers at the Maritime Station of Rocha Do Conde De Óbidos, Lisbon: A Multi Analytical Research

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This paper reports the first diagnostic survey of the six controversial mural paintings painted in 1946-49 at the Maritime station of Rocha do Conde de Óbidos in Lisbon, considered the artistic epitome of Almada Negreiros mural painting art. Four research questions driven this research: a) What are the main decay phenomenon's present and sources? b) Which are the paint layers more affected and are they link to a particular pigment? c) Is there any relation between the painting technique used and the deterioration/stability of the paint layers and pigments? And finally, d) Are there differences on the decay phenomena between the two maritime stations of Alcantara?

The analytical setup included in-situ technical photography in the visible (Vis and Vis-RAK) and ultraviolet radiation (UVF); h-OM, Vis-Spectrophotometry, Colorimetry and EDXRF. These techniques were further complemented by laboratorial analysis of microsamples collected from stable and deteriorated paint layers with OM, SEM-EDS, μ-FTIR, and Py-GC-MS.

First results indicate flaking of the paint layers as the main, and the more severe, deterioration feature currently present in most of the murals. The green, the browns and the blacks are the colours more affected showing different degrees of loss. The pictorial technique used, the presence of salts in the structure and, even the products used on past intervention, may be at the origin of this phenomenon.

Fig1: Detail in Vis-Raking light showing severe flaking of green and brown paint layers in P3. Gare Marítima da Rocha do Conde De Óbidos, Lisbon.
Photo by: Manuel Ribeiro2022

Acknowledgements

FCT funding through Project ALMADA, PTDC/ART-HIS/1370/2020, Contract Program Ref. DL57/2017/CP1338/CT0001 and Individual Scientific Employment Contract nr. CEECIND/00791/2017. Keelie Rix would also like to thank the Education, Audiovisual and Culture Executive Agency (EACEA) for her scholarship to attend the Erasmus Mundus Joint Master in ARCHaeological MATerials Science.

colours 22

MONDERN AND
CONTEMPORARY ART

Session 4

SCIENCE AND TECHNOLOGY APPLIED TO COLOUR STUDIES

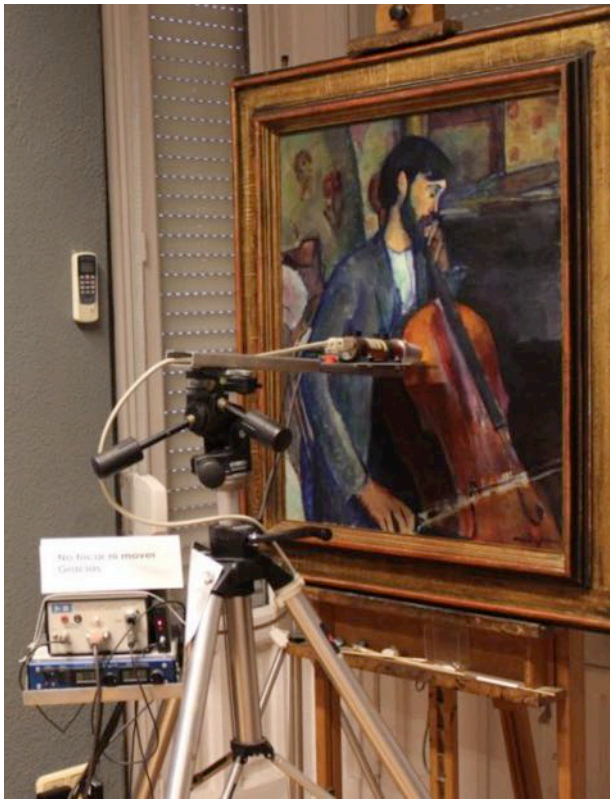
3D image survey of deteriorated paint layers. 1946–49 Mural painting detail by Almada Negreiros at the Maritime Station of Rocha do Conde de Óbidos, Lisbon.

16_ Images study and material characterization of the double-sided painting The Cellist and Portrait of Brancusi by Amedeo Modigliani

Greta Garrcía[1], David Juanes[1]

[1] Institut Valencià de Conservació Restauració i Investigació. IVCR+i.

The cellist, and *The portrait of Brancusi* were executed by Amedeo Modigliani in 1909. This canvas painted on both sides contains two previous studies for two of the most representative definitive works of the artist's early days in Paris. The collector, Juan Abelló, agreed to that a complete image study was carried out at different wavelengths (IR, UV and RX) as well as pigment analysis using X-ray fluorescence. The valuable information gathered revealed the preparatory drawing made in pencil, another underlying painting , and the use in this period of pigments in his palette not registered until then. This valuable information allows us to know the barely studied technique of the painter from this early period, and thus collaborate in obtaining scientific information that helps combat the serious problem of the falsification of his works.



Pigment characterization process. X-ray fluorescence.
Source: IVCR+i.

17_ Cobalt pigments and the spectrum of colours they create

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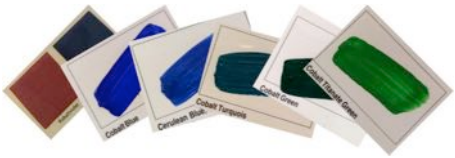
Pigment characterisation on modern and contemporary paintings and other works of art is crucial for finding solutions to conservation and restoration issues. A variety of non-destructive analytical techniques, specifically elemental and molecular spectroscopies, are commonly employed for this purpose, and libraries of reference spectra are used for identification. Although cobalt was isolated by the Swedish chemist Georg Brandt in 1735, a wide range of cobalt compounds have been used since early antiquity for paints, and to impart a rich blue colour to glass, glazes, and ceramics. Smalt was the earliest widely used cobalt-containing pigment, becoming in the 17th century a distinctive blue pigment in baroque style painting. Eventually, cobalt featured heavily in the development of some of the early synthetic pigments. In the 19th century, cobalt pigments, often combined with other elements to produce a variety of colours beyond blue [1-3], became significantly intense and stable, prompting a large number of artists to experiment with them until the present day. In this research, a number of swatches of historical and modern cobalt-based pigments applied in different binders (oil, casein, acrylic resin and polyvinyl acetate) and produced by different artist's paint manufacturers between the second half of the 20th century and the early 2000s were selected. The swatches were used as a tool to evaluate and test a range of spectroscopic methodologies for pigment identification as well as to expand the spectral database of the Conservation and Art Technological Studies laboratory (CATS) of the National Gallery of Denmark (SMK). The paints were initially examined by XRF spectroscopy to verify the presence of cobalt and accessory elements, and subsequently by reflectance spectroscopy to characterise their molecular properties. While most of the measurements provided a good match between the suppliers' colour descriptions and the analytical results, the chemical compositions of some colours were revealed either to contrast with the details in their labels or to be different from one supplier to another. Whereas the former group includes exclusively violet paints, the latter group is mostly composed of blue and green tints, whose composition can vary greatly from one manufacturer to another and can produce very heterogeneous results. Because the data yielded by XRF and reflectance spectroscopies was not sufficient to fully understand the multifaceted nature of such pigments, additional analyses were carried out by micro-Raman and external reflection-FTIR spectroscopies, to obtain supplementary information. While only few pigments could be further characterised by their Raman spectra, the FTIR analyses provided a knowledge base for the evaluation of the effect of different binders on the pigments' spectral features. This research aimed at investigating cobalt-based colours with a range of spectroscopic techniques, and the obtained results confirmed the effectiveness of complementary analyses for non-destructive identification of pigments in different binders. Also, this work highlights the importance of building a spectral database of cobalt-based paints from the second half of the 20th century that will be of significant value as a reference for other researchers in the field of heritage science.



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18_ António Carneiro's painting collection from the Museu da Cidade do Porto: Study and conservation in the 150th anniversary of the painter's birth.

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António Carneiro (1872-1930) was one of the most important Portuguese painters of the transition between the 19th and 20th centuries. His work is represented in the collections of several Portuguese institutions, but it is in the Ateliê António Carneiro, which is part of the Museu da Cidade do Porto, that the largest number of paintings, in addition to drawings, photographs, documents and personal objects of the artist, are concentrated.

With this communication we intend to contribute to the knowledge of Porto painters of the 19th century whom, although widely studied in the field of Art History, remain practically unknown in terms of their creative processes and respective artistic techniques [1-5].

The results of the first laboratory study of António Carneiro's pictorial work are presented, focused on the characterization of supports, paints and varnishes used in a selection of 10 oils on canvas, representing the entire period of activity of the artist, using the following techniques:

- Visible fluorescence photography with ultraviolet radiation to identify areas where varnishes were used, their characterization, degree of alteration and subsequent interventions;
- IR Photography and reflectography to characterize the drawing technique, whenever it exists, and assess the extent of any damage;
- Digital microscopy to capture images of the support structures, areas of overlapping layers, brushstrokes, surface texture and alteration phenomena;
- X-ray fluorescence spectrometry for elemental characterization of the pigments used and observation of their distribution (2D mapping) in areas where the mixture of pigments made difficult their elemental characterization in separate;
- Infrared spectroscopy for summary characterization of the classes of binders and varnishes used and also of some pigments.

This work is part of a broader project which, in addition to continuing the laboratory analysis, will include:

- The survey of the artist's personal documents, in search of clues related to his pictorial technique;
- The comparison between supports (canvas, paper and cardboard), stretchers and frames used in the works and those that were available in the Porto market at the time.

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19_ XIX- XX century inks: disclosing the composition and the degradation mechanism of dyes in historical collection

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Throughout history, inks have been obtained from many different coloured extracts of plant and animal origin, along with synthetic dyes after the development of synthetic chemistry [1]. The 19th century was a period of great technological and industrial innovations, in which both natural and synthetic dyes played a fundamental role in the production of inks [2]. In the early 20th century, the use of synthetic dyes became a trend in art and in ink formulation, prolonged in the 21th century. For these reasons, the study of 19th-20th century inks could provide important insights to reveal the secrets behind the synthetic dyes used in the 20th-21th century for the production of tube paints (e.g. LeFranc materials) or spray paints (fluorescent paints used in street art).

From an analytical point of view, identifying the inks in drawing or manuscript samples is challenging due to the variations in the ink composition and empirical formulations used over the centuries; at the same time, the characteristic components of an ink are subjected to changes in their chemical profile due to aging and fading. To reveal trends in ink formulations, a multi-analytical approach was developed for the analysis of historical inks and applied to a collection of materials produced in France in the late 19th - early 20th century. The array of analytical techniques used comprises high performance liquid chromatography coupled with diode array and mass spectrometric detectors (HPLC-DAD, HPLC-ESI-Q-ToF), pyrolysis coupled with gas chromatography-MS (Py-GC/MS), Raman, TLC-SERS and X-Ray Fluorescence spectroscopy. HPLC-DAD-MS2 analysis also allowed us to perform studies on the degradation mechanisms of ink dyes, providing useful results that can be used for ink identification in historical samples.

Our studies lead to a broad overview of the composition of French inks in the late 19th - early 20th century, and they could provide the springboard for a new way to investigate inks in historical samples by introducing ultra-sensitive chromatographic and mass spectrometric methods in the array of analytical tools. At the same time, the results obtained could be useful to better understand the behaviour of synthetic dyes present in characteristic artistic materials of the 20th-21th century, such as tube or spray paints.

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20_ Color and technique in the contemporary painting collection of the Universitat de València, Spain. The landscapes of the painter Manuel Moreno Gimeno

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The Universitat de València brings together artistic collections of great value that embrace more than five centuries of history (1499-2022). Among them, the collection of contemporary painting stands out for the diversity of artists, supports, artistic techniques and themes that distinguish it. One of the objectives of the Vice-rectorate for Culture and Society of the Universitat de València is aimed at the study, conservation and dissemination of its heritage collection, implementing innovative methodologies that place our artistic collections at the forefront of research and transfer. In this sense, the Laboratory for Analysis and Diagnosis of Works of Art of the Universitat de València has recently optimized a multilevel artistic diagnosis methodology that combines Digital Radiography, Infrared Reflectography, Multiband Imaging and Hyperspectral Camera to address the non-invasive study of artistic painting from different times and cultures. The final goal is to obtain excellent results on the materiality of these works of art (composition and execution technique), of great interest for developing preventive conservation plans for the collections and for the design of innovative exhibition proposals of an immersive and accessible nature.

In this communication we present the results gathered by applying this combination of techniques in three oil paintings on canvas that were made by the painter Manuel Moreno Gimeno between 1943 and 1947, which testify to the high heritage value of the contemporary painting collection of the Universitat de València.

21_ Orthodox icons and wall painting in Serbia – from the tradition to the modernity and back

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Interiors of the Serbian Orthodox churches were decorated with great care and devotion throughout centuries. Monuments conserved from the Medieval period until today are painted in different styles and painting techniques: from the traditional Byzantine style, through the modernisation of the 18th century with Baroque influences, and later, in style of the modern painting movements, to the actual neo-Byzantine production. The materials and techniques painters used had also changed: from egg tempera and fresco, to oil and acrylic. One of the key periods in the process of the modernisation of religious art was 18th century influence of Baroque painters coming from Ukraine. The changes introduced by Ukrainian masters, who came to teach Serbian icon painters the "new manner" in painting, had important consequences in the local icons and wall painting production.

Besides showing a wider picture of the stylistic changes, visible in the conserved religious interiors, this paper contributes to the technical examination of historical paintings with the study of the two 18th century icons related to the modernisation in Serbian religious art. Selected icons belong to the collection of the Gallery of Matica srpska. One icon was painted by Ukrainian painter, Jov Vasilijevič, the teacher at the local Serbian painting school, and another by his student and later collaborator Vasilije Ostojić. These painters worked in the most important churches and monasteries, showing the 'modern style' in both icon and wall painting.

Two icons are analyzed by means of XRF and Raman spectroscopy. The results are compared with previously existing data about works attributed to Jov Vasilijevič in the same region [1]. Raman spectroscopy and X-ray fluorescence (XRF) spectroscopy are often used as complementary techniques that are well suited for the analysis of art objects [2]. Both techniques are fast, sensitive, and non-invasive, and measurements can take place in situ [3]. In this study, Raman spectroscopy and X-ray fluorescence (XRF) spectroscopy are used separately, in the sense that the spectra are evaluated independently and single conclusions are obtained, considering both results.

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22_ Comparative study of two multispectral imaging systems on the Arxiu Valencià del Disseny interior design samples

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Cultural heritage study using multispectral (MSI) [1] and hyperspectral (HSI) [2] imaging techniques has grown significantly from the beginning of the 21′s century to the present. This boom has been related to the digital imaging development, with the appearance of cheaper and easier-to-use tools. Mostly, multispectral imaging techniques allows obtaining colour and reflectance data from an image captured in different bands of the electromagnetic spectrum. This properly processed information has unlimited possibilities in cultural heritage study, since it can be used to characterize materials, degradation, or ageing processes in a qualitative or semi-quantitative manner. In this way, multispectral technologies have favoured a scientific approach for the archives and collections documentation around the world.

In this communication, we present a comparative study between two multispectral imaging systems applied on heritage objects from the Arxiu Valencià del Disseny (AVD) in the Universitat de València (UV). This recently created archive, made up of different professionals and design companies' donations, depicts an historical memory of Valencian Community industrial and graphic design. For this project, we used some interior design watercolour samples registered with two multispectral imaging systems, one low-cost system based on digital photography and open-source software [3] and another one for the industrial use with privative licence software [4].

One of the systems made it possible to combine the technical photographic documentation (UV-Vis-IR) with the multiband image. Multiband photography allowed the analysis of eighteen captured images with filters in the visible and near infrared zone (400-925 nm, 18 bands) and their processing with open-source software. The second system, based too on the hyperspectral image in the VNIR zone (400-1000 nm, 204 bands), even though it was not useful for the photographic documentation, it favoured the data acquisition and processing thanks to the proprietary software automatization mechanisms. Therefore, it was observed that colorimetric information, calibration, and data processing was more limited in one system than in the other. Finally, this comparison aims to expose considerations to take account when purchasing these tools, rating issues such as affordability, versatility of use, and obtained data for each system.

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23_ Colour and technique in a 1969-Portuguese painting portrait of *'Faiunça'* by Armando Matos Simões (1933–)

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The sculptor Armando Matos Simões (1933–) and the mould-maker José de Jesus Branco (1931–1982), nicknamed 'Faiunça', became friends during childhood, as orphans living in the Portuguese State Care Home *Casa Pia*, in Lisbon [1]. This institution offered them professional training in their respective artistic trades. Matos Simões subsequently graduated in Sculpture in the Superior School of Fine Arts of Lisbon (1953-1958) [2]. From then onwards, he pursued a career in sculpture and medal design, while simultaneously holding a broader interest in other artistic activities, notably drawing and painting. In the early 1980s, Matos Simões destroyed part of his artistic production and the portrait of 'Faiunça' is one of the very few surviving artworks that was rescued and preserved by a friend of the artist [3]. Painted in 1969 on a high-density wood fibreboard known as 'Platex' – an innovative type of support for that time –, this painting is the very first work by Matos Simões to be investigated.

To gain a better understanding of the artist's technique and his choice of materials, the painting was examined *in situ* with non-destructive imaging techniques (Vis-UV, IRR, Radiography and digital microscopy) and portable analytical instruments such as FTIR and FORS. Seven micro-samples were collected and analysed with optical and spectroscopic techniques (OM, SEM-EDX). The main objective consisted in identifying the pigments and binder used in the preparatory and paint layers and characterising the paint structure. Aspects related to paint build-up, working tools and final varnish coatings give a first insight into Armando Matos Simões' technique and the skills he developed as a painter, while bringing to light practices related to Portuguese painting of this period.

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24_ Traditional and modern colours in Gino Severini's murals

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From the early 1920s, the renowned Italian artist Gino Severini (Cortona, 1883 - Paris, 1966) included wall paintings, together with mosaic and easel paintings, as a mean of expression. His first mural is in 1921-22 at Montegufoni Castle, in Toscany, where he decorated a *studiolo* with characters of the *Commedia dell'Arte*. His subsequent murals have a religious subject and can be found in five churches in the Romand region of Switzerland: St. Nicholas de Myre in Semsales (1924-26), *Notre-Dame-de-l'Assomption* in La Roche (1927-28), St. Pierre in Fribourg (1933), Notre-Dame du Valentin in Lausanne (1934), and *Couvent des capucins* in Sion (1947). In these churches, Severini painted religious subjects within the framework of the activities promoted by the Catholic society known as *Groupe de Saint-Luc* [1]. Although mural art was an important phase in Severini's artistic development, a comprehensive technical and stylistic study of his wall paintings is missing. The lack of this knowledge led to the 4-year research project (2018-2022) entitled "*Gino Severini in Switzerland: mural paintings and Catholic art revival of the Groupe de Saint-Luc*" [2], which aims, through an interdisciplinary approach, to understand Severini's expressive intentions and his technical choices in terms of both materials and painting procedures. For these purposes, historical and archival research has been integrated with onsite visual and scientific examination of the Severini's wall paintings.

This contribution illustrates the results obtained by the research project focusing in particular on Severini's pigments choice. Preliminary information about surface distribution and optical behavior of the paint layer emerged from the set of images collected by technical photography in different spectral range (visible, infrared and ultraviolet). For example, the presence of modern pigments like zinc white, cadmium-based yellow and orange, and red lakes was hypothesized due to their characteristic UV-induced visible luminescence, while the concomitant presence of visible-induced infrared luminescence suggested the specific presence of cadmium-based pigments. Portable X-ray fluorescence (XRF) confirmed the elemental composition of these pigments and combined with reflection FT-IR spectroscopy allowed the non-invasive identification of several other pigments, i.e. synthetic ultramarine blue, cobalt blue, *Sangiovanni* white, vermilion, ivory black, chrome-based greens and ochres/earths of various colour. Laboratory invasive analyses (SEM-EDS, μ-FT-IR, chemical imaging FTIR-FPA, and μ-Raman) of some sample cross-sections allowed the specific identification of pigment formulations (e.g., Viridian and synthetic alizarin lake) [3]. Overall, Severini used traditional pigments and modern ones with different painting techniques (e.g., Severini used zinc white exclusively a secco). The study shows that generally, Severini used the similar/same kinds of pigments in his murals with the exception of cerulean blue (cobalt stannate) and a lead-tin yellow, which were found only in two occasions. The characterization of the artist's palette is of great support for understanding the technical painting process used by Severini and his interest in new painting materials available on the market.

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25_ Solid state NMR depth profiling and spectroscopy of paint layers in support of the conservation of a white sculptural environment by Louise Nevelson

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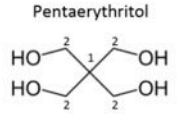
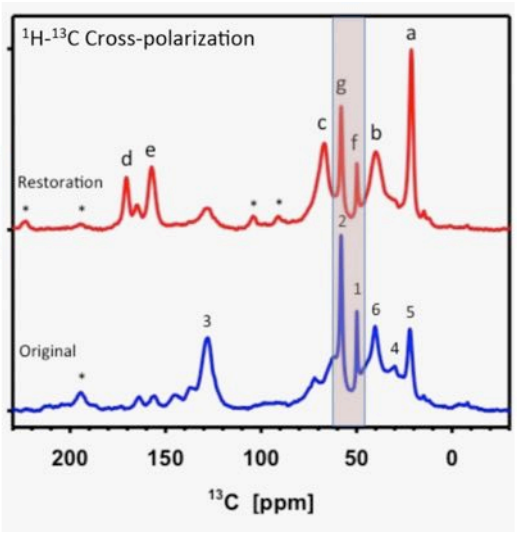
The presented project covers very different aspects: The objective was the conservation of the painted wood work of a chapel (Erol Beker Chapel, St. Peter's Church, Manhattan NY) created by the sculptor Louise Nevelson in 1975. The chemical composition of the different paint layers (original and previous restoration attempts) was determined by 13C solid state NMR spectroscopy [1]. Profiles (1D images) of the paint layers were taken by a portable unilateral NMR scanner before and after the application to study the effect of new types of gels for the removal of the restoration layer [1]. In order to enhance the resolution, a probe was developed that allowed the measurement of the profiles from paint chip samples in the gradient of a high field NMR magnet [2]. For a faster imaging by means of broadband uniform excitation of the 1H nuclear spins, very short frequency modulated radiofrequency pulses have been designed. The profiles not only allowed the discovery of a very thin surface layer, but also visualized the migration of plasticizers and their accumulation at one of the layer interfaces.

Pentaerythritol





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26_ Unveiling a World of Dreams: A Multi-Technical Analysis of The Pink Bows (1937) by Paul Delvaux

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The Royal Museum of Fine Arts, Antwerp (KMSKA) holds an extensive collection on Belgian modernist painters, which is being researched as part of the museums mission.

In 2021, The Pink Bows by Paul Delvaux (1897-1994) underwent a conservation treatment to remove a highly irregular and very yellowed varnish, unveiling its originally intended cool colours.

Delvaux's work makes up an important part of Belgian art history as his oeuvre spans from the early Interwar period to the end of the 20th century. However, no systematic research has been conducted yet on the studio practice or built-up of Delvaux's paintings. Therefore, the KMSKA sought assistance from master thesis research, dovetailing with ongoing conservation treatments, to initiate research on Delvaux. The main goal of this thesis is to investigate the modus operandi of the painter by characterising the painting materials.

While the research is still ongoing, some analysis already has been conducted: Conventional imaging techniques (UVIFP, UVFC, IRP, and IRFC), chemical imaging (Ma-XRF) and sample analysis (optical microscopy, Py-GC/MS and THM-GC/MS, carried out by the Royal Institute for Cultural Heritage Brussels). To further explore the painting, access to Iperion HS MOLAB facilities has been granted recently. The outcome of these methods will allow us to get a multi-perspective view on The Pink Bows.

We present the initial results of this pioneering approach to a Delvaux painting, mainly drawing on the interpretation of the Ma-XRF scans, supported with the results of the aforementioned methods and literary resources. This will give the reader an insight in the build-up of The Pink Bows, primarily of the pictural layer. Up to now we believe Delvaux used a traditional colour palette that is concurrent with the time of creation.

Figure 1: The Pink Bows *(after conservation) by Paul Delvaux, inv. 2850 © Jan Klein-Gotink, KMSKA, Antwerp*

27_ Colonization of stones: Raman spectroscopy of microbial pigments, from rock outcrops to monuments

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Cyanobacteria and algae are common colonizers of mineral surfaces. The special situation occurring at the interface of rocks and organisms is well manifested by coloration that is not inherent to rocks or minerals. Microbial colonizations can preferentially be followed on some rocks: frequently on porous sandstones, on sedimentary or metamorphic carbonates, limestones or marbles, on granite or gypsum [1]. Here we will give an overview of Raman spectroscopic detection of pigments from rocky outcrops (mainly gypsum) and those commonly found in the frame of historical buildings of temperate areas. Similarities and differences between superficial colonization (mostly epilithic growth) and endolithic occurrence and development of cyanobacterial colonies are highlighted. We present new data on the presence and distribution of carotenoids and protective pigments from several locations. In the Bohemian Massif, a number of rocky sites of endolithic and epilithic colonization of several rock types were investigated. The presence of mainly cyanobacterial pigments from South Bohemia (Opolenec, marbles, Holubov, serpentinites) is shown. Other studied sites of mainly gypsum endoliths are located in the Carpathian foredeep (Silesian unit, eastern Poland), and from Messinian complexes in the Mediterranean (Sicily, northern Israel). Aside of carotenoids, especially UV-protective non-carotenoid pigments scytonemin and gloeocapsin are detected [1]. Pinkish to brownish coloration is well known from plasters of common buildings as well as from cultural heritage buildings and monuments starting from 21st century. Examples of pigment detection and discrimination mainly of caroptenoids using Raman spectroscopy will be given to show these recent alteration. Prominent pink coloured epilithic colonization of sandstone and marble building stones of two UNESCO monuments, Convent of Christ in Tomar and the Cathedral of Évora (Portugal), caused by the Rubrobacter (bacteria) and Rhodotorula (yeast), were studied by Raman microspectrometric instrumentation in detail [2] and using several miniaturized Raman spectrometers ($\lambda = 532$ nm) in situ. Raman spectroscopy can be seen as an undervalued tool for detecting and discriminating biological pigments. Additionally, the knowledge of precise colonists clarifies approaches for stone cleaning, stabilization and its restoration.

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28_ Macro-Raman mapping: a novel approach in the analysis of art objects

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Since a couple of decades, Raman spectroscopy became increasingly in vogue for the analysis of precious objects of art. Not only its ability to obtain molecular spectra of inorganic and organic compounds make this a versatile technique, but also the non-destructive character of the technique is highly interesting in this field. Indeed, the non-invasive approach is even more clear when mobile instrumentation was used for the in situ investigation of artworks in different environments.

Until recently, however, the analysis of precious objects that cannot be sampled was limited to point analysis. When a series of point measurements are performed in a structured way, it is possible to obtain a macro-Raman map: at each point in a 2-dimensional grid a Raman spectrum is recorded, resulting in a 3-dimensional data cube (2 spatial coordinates, 1 spectral coordinate)[1]. By applying appropriate data-processing methods, it is possible to extract useful information and present this as an image, that can be of use in technical art history.

During this presentation, technical details of the set up will be discussed and the approach will be illustrated with examples of macro-Raman maps.

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MFT Workshop

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Microfading is a relatively new technique used in conservation science to evaluate light sensitivity of objects in a non-destructive way. The micro fading tests (MFT) could be performed for nearly all classes of materials found in museum collections, and the method is particularly suited to study fugitive objects (works on paper – manuscripts, prints, watercolors; canvas paintings; textiles). Data obtained for a given object allows to rank it against light sensitivity standards, i.e. the ISO Blue Wool Standard, which are widely used reference materials for lightfastness. The microfading tests helps to adopt exhibition policies to actual data obtained for each tested object rather than use general assumptions which could be either to conservative (and unnecessarily limit viewers access to the object) or to optimistic (and lead to irreversible light-induced damage). During the workshop a state-of-the-art equipment for MFT would be available to participants. Following a short introduction to the accelerated ageing and color science several practical tests will be performed on-site with a full data evaluation and discussion. Participants are encouraged to bring a suspected light sensitive objects for testing.

Tomasz Łojewski, PhD, specializes in research and education in the field of conservation science. In the years 2006–2016 he was the head of the Laboratory of Research on the Durability and Degradation of Paper and the organizer of the postgraduate studies "Modern analytical techniques for the conservation of heritage objects" (both at the at the Jagiellonian University, Krakow). Co-founder of the Paper Clinic at the Jagiellonian Library, Krakow. Currently employed at the Faculty of Materials Science and Ceramics at the AGH University of Science and Technology, Krakow. Main research interests: new methods of paper conservation and imaging of heritage objects, nondestructive lightfastness studies for heritage materials.

colours 22

MONDERN AND
CONTEMPORARY ART

Session 5

CHALLENGES FOR CONSERVATION-RESTORATION

Technical Photography. 1946–49 Mural painting detail by Almada Negreiros at the Maritime Station of Rocha do Conde de Óbidos, Lisbon.

29_ A new challenge for the restoration of chromatic identity of the M'zab Valley, Algeria

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The M'zab Valley is a famous historical region located in Algeria, North Africa, and it is listed in the UNESCO World Heritage list since 1982 as an intact example of traditional human habitat perfectly adapted to the environment.

This work aims to study the chromatic identity of the five villages that form the M'zab Valley site called "Ksour" and it is based on the study of vernacular culture and the used colors in the external façades of the human settlements of the Ksour. Our method consists in analyzing those external chromatic components and the color preferences of the inhabitants as well as the existing correlations between them.

Till now, our outcomes suggest that the restoration of the colors in the Mozabite urban landscape could be linked to the personal color preferences of the inhabitants that share the same culture and values. Furthermore, this restoration could be made using a specific protocol in order to standardize the restoration of the coloration in further operations of heritage restoration.

This approach has important implications with regard to how we should preserve the chromatic character and identity of the urban landscape in the M'zab valley, as well as its impact on the issue of the restoration, specially in what concerns to the use of colors, of cultural heritage sites in the world.

30_Colour in Modern Architecture of Olivetti's Town

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Ivrea is a small city known throughout the world for the Olivetti Company. Less well known internationally, in its starting years, was the innovative urban and architectural experiment inspired and strongly desired by Adriano Olivetti, financed by his company for a long part of the XXth century. Nevertheless, his patronage and his far-sighted vision for the "society of men" have produced results of great relevance in the history of Italian industrialization and Modern Architecture. Since 2018, the system of architectural assets, the archives, the cultural heritage with its social experiments, have become part of the UNESCO Catalogue of W. H. Sites. The formal history of Olivetti's architecture can be instrumentally divided into two major periods around the turn of the Second World War: the more austere pre-war period, dominated by the unchallenged presence of architects Figini and Pollini. Then, the more casual post-war and 1950s period, developed by a multiplicity of architects of different backgrounds. In the first period, the use of colour in the context of Ivrea was at the same time discreet but widespread. In the second post-war period, renewal in architecture was also driven by the wider use of industrially produced materials and renewed forms; it was in this period that colour made its way powerfully into Olivetti's architecture. First in the guise of Nizzoli's "chromatic comments" on the residential buildings of the Canton Vesco district and then, with much more determination, in the buildings designed by E. Vittoria. In fact, it was precisely the buildings designed by the brilliant Neapolitan architect that gave rise to the use of coloured surfaces in an environment until then dominated by modern buildings with large glass surfaces, light ochre walls and partitions lined with local stone. This "chromatic revolution" was supported by new ceramic products that drastically reduced the maintenance operations of the surfaces. Their adoption by the Factory Technical Bureau was immediate and spread to civil architecture. It seemed, at the time, that these materials could also contain the degradation of the exposed parts of buildings. Today we know that this is not the case: even materials that were supposed to be "eternal" show clear signs of degradation, posing burning questions and problems difficult to solve for those involved in the recovery of buildings. We have to preserve the materials in place, not to impoverish the image of the buildings in their original conception; at the same time, we have to ensure protection to surfaces, structures, components and building systems in their performance characteristics. On these goals, the contribution proposes two convergent approaches: 1) on the level of method, supporting the value of a constant and precise analysis of materials, trying to refrain from the image of an 'Olivetti's architecture' flattened only on rationalist models - chromatically limited - to rediscover a less minimalist vision that has characterized this heritage since its inception; 2) on the operative level, highlighting attempts to restore that "world of colours" that was the Olivetti's town, with its related correct lexical reading of architectural elements, not overlooking the finding of materials (regarding on "what can be done today", as many original products are no longer available.

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31_ Street art and cultural heritage. Conceptual issues and operational choises

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The graffiti have long been held up as vadalic acts and in part they are. however, in this great world of graffiti it is made up of both "tags" and "street art", which in recent years is starting to receive great acclaim. Street artists compose these large murals through which they tell the stories of the world, denouncing violence and attracting attention to social and cultural issues with their art.

Blu, Bansky, Ericailcane are just some of the names of internationally famous artists who do not fail to underline their own cultural claims with their works. l the problem arises when these works are carried out on the walls of buildings that are themselves monuments. The problems are many and concern copyright, the possibility - or not - to destroy street art works, but also to preserve and reintegrate them, given that they are works that are born, in the authors′ idea, to be introduced into the flow of time, accepting their destruction.

With the example of a practical case: the re-functionalization of the Campobasso market, a work of contemporary architecture subject to constraint and covered with graffiti.

32_ The color and rehabilitation of architectural surfaces as heritage value and its contribution to the image of historical cities: the case of the National Theatre of São Carlos

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The growing phenomenon of Urban Rehabilitation, particularly in the city of Lisbon, has hastened the disappearance of historical architectural surfaces, in a tendency of "pricking to the bone", for allegedly economic reasons and for lack of knowledge of the importance of maintaining the old protective layers of buildings, when firmly attached to the masonry walls. Those interventions condemn the values of authenticity and condition the historical knowledge of the building itself in the future, and of the historical urban context, whose visual memory is hopelessly limited.

The study of architectural surfaces, which represent a stratification of history, as palimpsests [1], is essential to the reading and complete understanding of the messages conveyed by urban landscapes throughout history, which should actively contribute to urban rehabilitation programs [2]. Unfortunately, these programs usually have not shown particular interest in the image of our historical cities, neglecting their historical authenticity.

The Restoration Charter of 1972 emphasizes the importance of safeguarding original surfaces and coatings, condemning the systematic renovation of surfaces [3], which has not occurred, and today the material evidence of color in historic cities is very limited.

The recent case of the discovery of the original color of the main facade of the National Theatre of São Carlos, in Lisbon, in 2019, during a restoration operation, was a remarkable example of this importance. During this action, small areas of an old color appeared between the stone elements, where the various repaintings did not achieve a good covering, making possible to establish a timeline of color layers until the XXth century. The older one, a blue colour, was discovered underneath the yellow color from which the building was recently painted. Afterwards it was possible to support this finding with iconographic testimonies present in an engraving from the 19th century, which triggered a process of recognition of the blue color, as the building's original color at the date of its inauguration in 1793. The reconstruction of its original color was made and redeemed the authenticity of the building itself, whose valorisation is evident, as well as the urban context where it belongs.

This unique example in the city of Lisbon should encourage reflection about the practices of Urban Rehabilitation that should promote the safeguarding of collective heritage values and define the intervention of public entities that have not shown sufficient power of surveillance and regulation, fulfilling the standards defined in the International Charters and Conventions on Heritage of which Portugal has been a signatory country.

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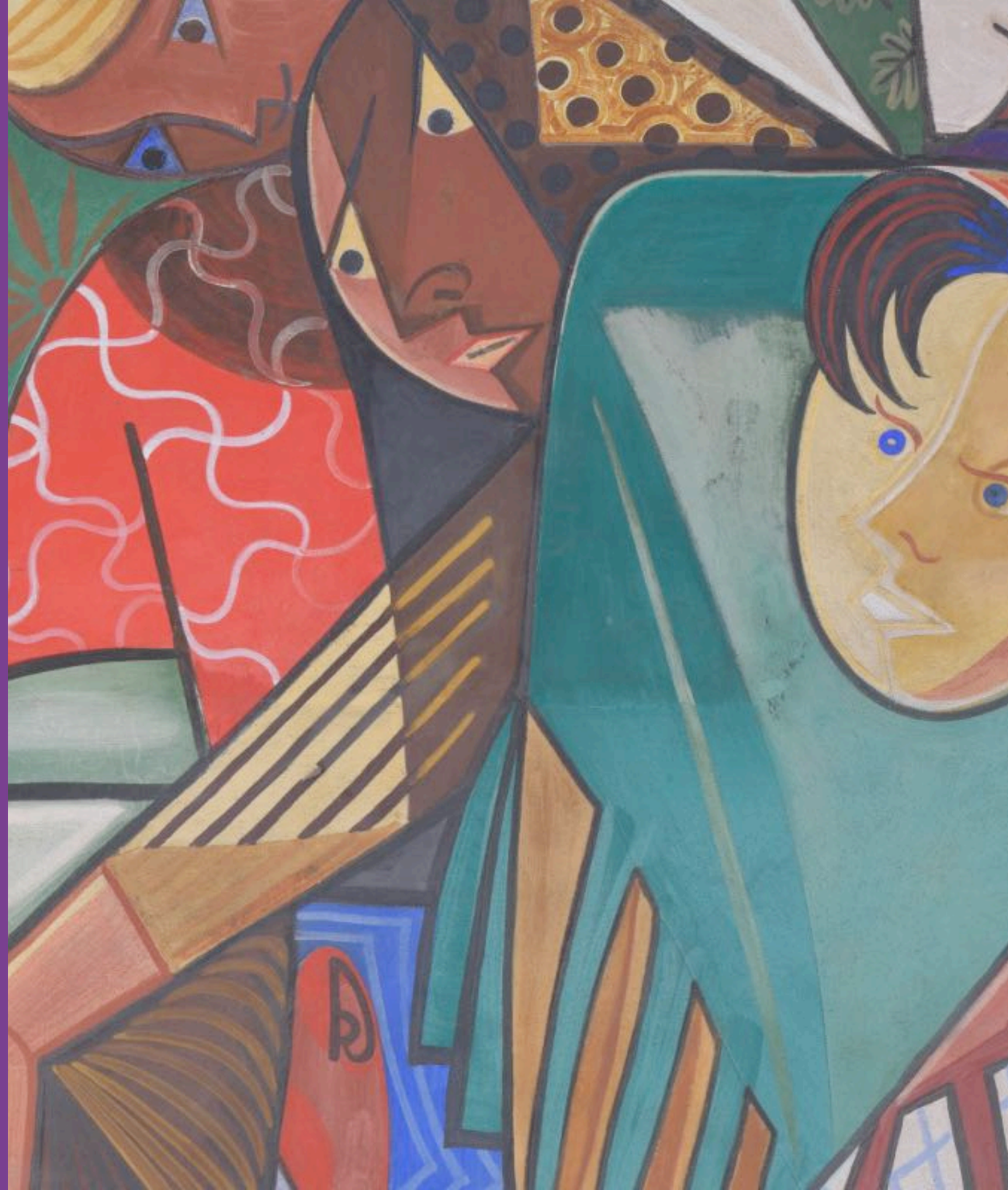
colours 22

MONDERN AND
CONTEMPORARY ART

POSTERS

1946–49 Mural painting detail by Almada Negreiros at the Maritime Station of Rocha do Conde de Óbidos, Lisbon.



P01_ Proposal of a methodology to evaluate the incidence of cleaning treatments on pictorial surfaces

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This paper presents a proposal on the development and application of a scientific methodology to assess the incidence (in terms of efficacy and harmfulness) of cleaning treatments on pictorial surfaces. Failure to consider and address technical issues that may arise during cleaning can cause irreversible damage to the painting surface. Since the effects of cleaning are irreversible, it is necessary to assess the incidence and compatibility between the cleaning methodology or product tested with the pictorial layer.

The methodology developed presents an analysis test procedure on specimens where, through different microscopic (EM, OM vis-UV, SEM), spectroscopic (EDX, FTIR-ATR, RAMAN), chromatographic separation techniques (GC-MS, PY-GC-MS) and by measuring the colorimetric coordinates, brightness and pH, it is possible to assess the effectiveness of the tested cleaning treatment and the appearance of possible damage. This may include the deterioration of the substrate, the change in porosity, roughness, color or gloss of the surface, the release of residual substances that could interfere with future conservation interventions.

In addition, a methodology is proposed for the preparation and adaptation of pictorial specimens, as well as the formulation, application and aging of artificial dirt film-forming substances, based on currently published works and protocols.

The purpose of the tests is to identify cleaning methods that produce an acceptable result with minimal risk to the paint surface. This work identifies the means by which cleanup methods can be selected and evaluated as part of conservation interventions.

P02_ *Cut flowers* by Joaquín Sorolla, the discovery of an original and its forgery

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In 2020, the Patrimony brigade of the National Police Corps, attached to the Valencian Community, intervened the allegedly false work Flores Cortada by Joaquín Sorolla that was going to be auctioned at the Art Market. This article reveals the scientific investigation carried out by the IVCR+i that improved to confirm its authenticity, but discovered the real fake, an exact copy of the same one that had been sold 10 years before as the original.

Pigment characterization process in the two works using RAMAN spectroscopy. Source: IVCR+i.

P03_ The luminescent rainbow

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The optical properties of all-inorganic lead halide perovskite nanoclusters (NCs) open up a new world for any artist to indulge in creation. $CsPbX_3$ (X= Cl, Br and I) NCs can be synthesized in the form of a solution, via the hot-injection method or by microwave assisted synthesis, to develop a wide colour gamut of inks [1]–[3]. These NCs can also be deposited in glasses, encapsulated in polymers or deposited in the form of membranes, while maintaining their strong photoluminescence when irradiated with UV light [1], [4].

This work will focus on the hot-injection synthesis for the production of $CsPbX_3$ NCs, on their tunable optical properties and some of the possible applications of these luminescent materials in art forms of many kinds.

Fig1: *Colour tunability of colloidal $CsPbX_3$ (X= Cl, Br and I) perovskite NCs dispersed in toluene under UV irradiation (λ=365nm) [1].*

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P04_ Restoration of damaged religious painting painted on linoleum

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Painting St. John Nepomuk is painted by famous Lithuanian painter Joseph Balzukevic (1867-1915) in 1903. It belongs to the heritage of Vilnius Calvary catholic church. Painting was stretched on originally made for the painting stretcher. Conditions of keeping this artwork in former times were not enough good and this made bad damage to it. Picture painted by oil paints on the non-traditional material of the support – on the linoleum. This material was very modern in the author's time and probably seemed to be stable for religious art for the church. But painting had a lot of deformations, nail holes ruptured and the support was not properly outstretched long time. The aim of the restoration was to consolidate paint layer, to flatten many of linoleum deformations and to find the new way how to fix painting support to the original stretcher. It was question what retouching materials to use and how to integrate retouched places into whole of special semi-gloss surface.

The first task of restoration process was to make support more elastic. After strengthening of the paint layer the painting was kept under certain conditions to obtain more elasticity and to finish support flattening process. Later followed by adding new edges arranged according the form of picture support which has special configuration in the upper part. Losses were filled by specially made ground from cellulose derivatives and wood dust. This ground was base to adjust retouching colours and with them to form certain integration to the low gloss of the painting surface.

Joseph Balzukevic, "St. John Nepomuk" 1903. Oil, linoleum, 127x82,5 cm

P05_ The secret of blue smalt

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Blue smalt has a long history as an artistic pigment [1,2], despite the stability problems associated with its use. Born as a colourant for the glass industry, many artists became aware of its versatility, making the leap to the pictorial palette at the beginning of the Renaissance.

The result of recipes relating to manufacture is very numerous and can divided into two main groups: the firts for the glass industry, and the second for the production of artistic pigments.

A detailed study of artistic manuscripts[3] and the workshop notebooks known as *Quaderni di fornace*[4] has made it possible to verify the existence of numerous variants in the formulas for manufacturing the pigment, intended to provide not only different shades, but also different qualities depending on the use for which it was intended, even within the same variety, as in the case of the so-called painters' blue[5].

This work includes studies on the processes of obtaining, synthesis and compositional variations, found in different artistic and industrial manuscripts, which will give rise to the different varieties of blue smalt, that could be found on the markets.

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P06_ Analysis of misconceptions about colour and development of educational resources for teachers-in-training

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Several studies have focused on the importance of detecting misconceptions in physics education. Even after formal instruction, students maintain misconceptions about concepts related to light and colour, reaching higher educational stages with low knowledge [1, 2]. This is especially relevant at the teacher training stage, as teachers' perceptions can influence the learning of their future students [3]. When explaining the concept of colour to students at different levels, it is found that many have difficulties in understanding the basic optical concepts involved. These misconceptions serve as a starting point to design and develop didactic sequences that promote a conceptual change and thus enable students to achieve meaningful learning of scientific concepts. The general objective of this research was to diagnose and analyse the misconceptions that future primary and secondary school teachers have about colour and the basic concepts of optics related to it. In addition, virtual teaching materials were developed and implemented to help combat the misconceptions found. A quasi-experimental design was followed with a control group and an experimental group with mixed qualitative and quantitative analysis. A total of 435 trainee teachers participated in the study by means of non-probabilistic sampling. This group was divided into different groups according to their degrees. Control and experimental groups were also used to analyse the didactic effectiveness of the resources developed. An online measuring instrument made up of closed multiple-choice questions with a single answer, designed based on previous studies [4], was designed and validated using psychometric tests. Subsequently, the design and implementation of educational resources that promote meaningful learning about colour in future teachers was carried out. The analysis of the results obtained revealed the existence of misconceptions in the participants, regardless of their degree of origin. Likewise, the didactic interventions developed helped to combat misconceptions, generating a conceptual change in the trainee teachers and improving their levels of knowledge and teaching self-efficacy.

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P07_ Colours of the Tijomel ceramic manufacture (1941-1992): characterization of the ceramic pigments

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The Tijomel ceramic manufacture was located in Caxarias (Ourém) in the Leiria district in central Portugal. The company was founded in 1941 under the name Materiais para Edificação, Lda by Júlio Redol, later changing its name to Tijomel (1961)[1-3]. Considered one of the most modern ceramic manufacturers in the Iberian Peninsula, its productions ranged from common ceramic building materials, such as common clay bricks, to sophisticated modernist azulejos and mosaics [1]. Tijomel designed and produced an unusual type of glazed elements applied as cladding in Portuguese Modern Architecture. Geraldes et al. [1] performed the first systematic research about the conservation of Modernist azulejos, conducting a first survey of the application of the glazed ceramic elements produced by the Tijomel manufacturer [1,2]. The 20th-century artistic ceramic production has been the subject of few technical art history studies compared with other glazed ceramic productions; therefore, the chemical characterization of these materials is sometimes necessary to design proper conservation strategies [4]. The heirs of the Tijomel manufacture recently discovered a set of 33 pigment samples dating from 1959 to 1962. The pigments, most identified by their original label, comprise samples from two English manufacturers Wengers Ltd and Blythe Colour Works Ltd.; two Portuguese companies Hans Barnstorf & Cª, Lda and Chambers & Cª., Lda.; and also from the German Degussa Ltd. company. In this study, pigments and glazed ceramic elements including the ones from a Material´s Catalogue of Decormel (Tijomel) belonging to the archives of the Laboratório Nacional de Engenharia Civil will be analyzed. Chemical, morphological and mineralogically characterization will be performed with Scanning electron microscopy, micro X-ray fluorescence, micro X-ray Diffraction, micro-Raman and Hyperspectral imaging. Studying the pigments and the final ceramic elements will help unveil technological aspects of the Tijomel glazed ceramic production and provide knowledge for future conservation strategies to preserve this valuable cultural heritage that has often been neglected, causing its irreversible loss.

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P08_ Reveal the Original Green: An Interior Investigation on An Italian Colonial Architecture in Tianjin, China

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Tianjin Macro Polo square complex was located in the exclusive Italian colonial in China, which was also the largest Italianate architectural complex in Asia. However, it is difficult to explain the complicated interior decoration and obscure aesthetic style due to the lack of investigation of decoration and literature. In order to restore the distinct square complex, architectural investigation, document research and scientific analysis were carried out to learn the original decorative art, which would provide significant reference for the conservation strategy design. The evidences provided by the microscopy and chemical investigations of the coatings over the window frame in one typical building imply that the window frame had been restored for several times historically. Furthermore, the very original color was unexpectedly identified as green which consisted of lead chrome yellow and Prussian blue. The analytical results of binding medium also indicate that the natural pine resin was replaced by synthetic resin such as alkyd resin during the several historical restorations. Overall, the development of interior decorative material in 20th century of Tianjin, a typical big Chinese harbor city, is well presented by this analytical research which would give a good reference for further restoration design.

P09_ "*Ce n'est pas la colle qui fait le collage*": investigating the materials in two works of Max Ernst

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Coined by cubist artists Braque and Picasso, the term "collage" comes from the French word *coller*, or "to glue." Technically it is a picture composed of cut-up scraps pasted together, but this does not adequately explain the method used by Max Ernst who developed his own collage technique in 1919; actually the Surrealist considered this "random" assembly of different things and materials to create a new entity as a way to express the unconscious and free the mind [1].

In the frame of a project aimed at disclosing the techniques and the materials used by the German painter Max Ernst in his *ouvres* belonging to the Peggy Guggenheim Collection in Venice [2,3], two collages were investigated by non-invasive in situ analysis (Vis-NIR multi-spectral imaging, X-ray fluorescence, external reflection FTIR and Raman spectroscopy).

The Postman Cheval (*Le Facteur Cheval*, 1932) is a paper and fabric collage painted with pencil, ink and gouache on manila paper and belongs to the series titled 'Loplop Introduces…' where Ernst pays homage to his alter ego Loplop Superior of Birds (present twice in this work) [4].

Sea, Sun, Earthquake (*La Mer, le soleil le tremblement de terre*, 1931) is a painting made with a mixed technique including oil, gouache, and collage on canvas: strips of wallpaper were applied on a coat of thick dry pigment, the joints being paint over with gouache [4].

This complexity of the works, testified also by Ernst's statement that "*Si sont le plumes qui font le plumage, ce n'est pas la colle qui fait le collage*" [5], nevertheless allowed the identification of the used materials (pigments, bindings…), giving a further contribution to the understanding of Ernst' masterworks and allowing an in-depth knowledge of his highly skilled work.

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P10_ The depiction of the female figure in the Katsigra Museum through the perspective of the most eminent representatives of the School of Fine Arts in Athens in the first half of the 20th century

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The establishment of the School of Fine Arts in Athens coincides with the foundation of the Greek state. After many adjustments the School managed to develop into one of the most important and most respected institutions in Greece following the standards of France and Bavaria. The most renowned and influential personalities have either teached drawing or studied at the School. This research studies how the female figure was depicted through the glance of the most important representatives of the School of Fine Arts during the first half of 20th century. Rather than a stable set of outlines, her physical beauty is an ever-morphing construct, eventually a muse that artists engage with sooner or later. Moreover, the reconstruction of the artists' colour palette and the pigments identification throughout their artistic creation, are issues that are going to be developed thoroughly. For this purpose, nine paintings have been analyzed in total, made by G. Roilos, G. Gounaropoulos, S. Vikatos, A. Geralis, V. Germenis, P.Mathiopoulos, E. Thomopoulos.

The research was made with the valuable help of new technologies. Three non-destructive methods, XRF, Raman Spectroscopy, Multispectral Imagine Camera and a micro-destructive technique, Libs, were used in-situ. The combination of the techniques above, provides the research with the most accurate results.

Figure 1 – *Girls Emboidering, G. Gounaropoulos*

Figure 2 – *Girl with naked back, G. Roilos*

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P11_ GeoPAINT [LX] Project: GIS of contemporary mural paintings from "MURO_LX" Festival in Lisbon (Portugal)

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The *GeoPAINT [LX] Project* is an academic attempt to document, study and monitor the artistic phenomenon of contemporary mural painting and to be a contribution to the conservation of this type of urban art, like some international projects [1] [2].

Using several features of Geographic Information Systems [3] was possible to produce a georeferenced survey enriched with geo-coordinates of a set of mural paintings. This strategy helps to document and monitor the artworks pieces. It was out in the scope of four Public Art festivals, which occurred in Lisbon, in various parishes: *Carnide* (2016), *Marvila* (2017), *Lumiar* (2019), and *Parque das Nações* (2021).

The Lisbon Urban Art Festivals, called *MURO_LX*, was developed by the Urban Art Gallery (GAU) to promote Urban Art in Lisbon. The Festivals have supported creating and producing new works in public space, promoting their national and foreign authors (Figure 1). More than two hundred national and foreign artists were announced in the four editions, producing about one hundred and fifty new urban art pieces [4].

Figure 1 – *Unity*, made by Pedro Podre (2021), in *Quinta dos Machadinhos* (Lisbon).

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P12_ The colours of deception: marble imitations in Alentejo stucco altarpieces

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During the 20th century, the way in which Portuguese society has related to its cultural heritage has been variable, directly dependent on psychological, cultural and even economic factors. For instance, the definition of the concept of "major arts" implied that some fringes of our cultural heritage were to be, inevitably, integrated in the "minor arts", thus giving way to prejudiced formulations that have conditioned the way a significant part of our cultural heritage has been interpreted. In the 21st century we continue to look at this issue through deforming "micro" or "macro" lenses, as Art History desperately seeks to analyse and classify what should (and should not) be worthy of safeguarding.

A good example is the heritage formed by the so-called "lime arts" [1], one of the identity marks of the Alentejo region: mural painting, stuccoes and "sgraffitos". Some techniques, like mural painting, have been subject of an increasing number of studies. Regardless, other categories remain that have not yet aroused enough interest of the scientific community.

In this paper we wish to highlight the stucco altarpieces with polychrome coatings, which populate the Alentejo, from north to south, since the 16th century. These art pieces have been misinterpreted in what concerns their constituent materials and construction techniques. Despite this fact, they are, at the same time, a proof of resilience, as well as of the successful use of some materials which are endogenous to the Alentejo (lime, bricks, pigments).

However, during the 20th and 21st centuries these altarpieces experienced a dual reality: a considerable part was left abandoned, whilst another was subjected to a wide variety of interventions, most with disastrous effects. Neither case helped the reappraisal of stucco altarpieces by our contemporaneous judgement.

One of the aspects where modern interventions had a more dramatic impact was in the polychrome coatings of stucco altarpieces, which had not only a protection function but, moreover, an important mimetic function of other materials, such as marble. These imitations, unequivocally described in the historical documentation, reflected the preferences of the commissioners and the existence of a competent workforce which carried them out. Unfortunately, today, the documental references to "stones from Montes Claros" or "stone from Salerno" find no resemblance in the sight of plastic paints and radical whitewashing covering the majority of these altarpieces. In fact, the dichotomy between over colouring or the complete eradication of colour, also present on the façades of Alentejo's vernacular architecture [2], seems to have overwhelmingly spread to these art pieces.

The contemporary alterations made to the polychrome coatings of stucco altarpieces have irreversibly distorted the mimetic potential that was their raison d'être. It is therefore important to reflect on what other functions remain for these objects, in the context of contemporary society, assessing what can still be preserved from an extensive legacy in imitation techniques.

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P13_ Revisiting colours and shapes of a "Memory fort": A Challenge for conservation-restoration

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COASTAL MEMORY FORT is an EEA Grants funded project that has as its main goal the revitalization and safeguarding of the Nossa Senhora dos Anjos de Paimogo′s Fort (Forte da Nossa Senhora dos Anjos de Paimogo), Lourinhã, Portugal.

The project COASTAL MEMORY FORT is reaching the local and scientific communities relating to local traditional techniques and materials towards increasing the public engagement to cultural heritage conservation. Experiments to conclude on the best traditional colours, shapes and materials combination to the restoration of the fort are being performed in co-work by the Municipality,the Laboratory and the local community.

Promoting the revitalization and safeguarding of the fort and community memories is an outreach of the project and also creating Opportunities for visitors and local communities to observe and experiment and learn about old traditional construction techniques (intangible cultural heritage).

COASTAL MEMORY FORT conservation and restoration challenges promote new opportunities for research to existing public institutions and local associations, and new scientific communities.

Moreover, workshops to learn about raw material technologies and traditional techniques for students, and other community members, and visitors, and municipality meetings to encourage discovery and discussion among communities of potential restoration and new uses for the fort will be performed.

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P14_ The Colourful Planisphere Painting of Almada Negreiros (Part1): phases of execution, technical and material details. Some observations.

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When we observe the 54m2 mural painting known as Planisphere (or Mapa-Mundi) located at the main hall of DN Building in Lisbon, it is hard not to be overwhelmed by the monumental scale of the mural, by the high number and quality of details portraying the fauna, flora, cultural, artistic, mythological, and historical events. We are even more impressed when we know that Almada Negreiros was a self-taught artist, and that this painting is considered his first accomplishment in the art of fresco. How did he managed it immediately resurfaces and impelled us to carried out the research in loco and in the laboratory.

The analytical setup included in-situ technical observations and photography in the visible (Vis and Vis-RAK) and ultraviolet radiation (UVF); h-OM, Vis-Spectrophotometry, Colorimetry and EDXRF. These techniques were further complemented by laboratorial analysis of microsamples collected from paint layers with OM, SEM-EDS and μ-FTIR.

This papers presents the first results of technical and material observations, and analysis, that reveals the execution phases of the painting, the strategy to overcome some technical features, highlight the mastery and the innovator character of Almada Negreiros in mural painting art.

Fig1: Detail in Visible light showing Almada's creativity and colour mastery to highlight the shadows and flesh tones, DN Building, Lisbon. Photo by: Manus2017

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P15_ Studies of the long-term effect of nanoconsolidants on mural paint layers with a lack of cohesion

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Mural paintings are subject of constant aging and deterioration as increasingly threatened by natural and human impacts, which over time may severely affect their structure and composition. The resulting degradation can vary from structural damage, aesthetic modifications, chemical and physical alterations of the paint layers, and mortar constituents. Among the deterioration features commonly found in these cases is the lack of cohesion of paint layers that brings the need for a consolidation treatment to strengthen its crystalline network and to improve the mechanical resistances within its structure. Nanomaterials, in particular nanolime, have been seen as a very promising alternative to traditional consolidants for preservation of mural paintings. Despite the research already undertaken with commercial and laboratory-synthesized nanolime, there is still little research on how the treatment would affect the paint surfaces in a longer time frame and how to avoid potential colour variation seen as white haze formation in the panted surfaces [1].

In the course of our studies on the development of innovative consolidants, we have analysed the effectiveness potential of laboratory synthesized nanolime for mural paintings consolidation [2,3]. With the purpose to verify the impact on the paint layer suffered after nanolime treatment, this communication demonstrates a comparative analysis of the long-term effects of three consolidants on the colour appearance of fresco paint layers affected by lack of cohesion. In vitro assays were performed after treatment with two kinds of nanolime (laboratory-synthesized and commercial), and a commercial acrylic resin applied by nebulization over two sets of replicas of buon and lime fresco painted with red and yellow ochres and smalt pigments. Our recent survey of the paint layers in 15 months after treatment will be discussed and also compared to our previous studies [3] before, in one week and one month after treatment. With this research we intend to widen the understanding of the effect the nanolimes on frescoes paint replicas with a lack of cohesion and to answer doubts raised by conservator-restorers.

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P16_ Testing advanced 2 and 3D imaging techniques on Almada Negreiros murals technical and material studies

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This paper repports the collaborations carried out in 2021-2022 in the framework of project ALMADA at the two maritimes stations and Escola BE Patricio Prazers in Lisbon. Two advanced imaging systems were experimented for technical and diagnosis studies of mural paint layers: a) 3D scans Artec Eva 3D Scanner and Artec Spider and b) XpectralTEK, an hiperspectral system from Xpectraltek.com.

3D scan technology was useful to quickly generate high-precision, dimensionally accurate 3D models from stable and deteriorated paint layers. These models carry color information as well as a 3d texture. The acquisition was done by Marius Araujo indoors, under indirect sunlight. Artec Eva 3d Scanner was used for larger areas, and Artec Spider for sharper detail acquisition in smaller areas. Scans were performed in parallel patterns at approximately 0.2 -1 m from the surfaces, keeping the scanner parallel to the surface and trying to cover the complete area of interest. The laptop used for all scans was a MSI Raider series gaming laptop, with an Intel core i7-8750h CPU @ 2.2GHz, 32Gb of RAM and a Nvidia Geforce RTX graphics card. Post Processing was performed on the same equipment, on Artec Studio 16 Professional software.

On the other han, the hyperpspectral system tested by Jani Santos is born in the world of imaging diagnostic in cultural heritage. Adjusting the knowledge in spectroscopy, imaging and computers to the flaws and needs of the market, XpectralTEK intends to help profissional in their daily work. In this case it enabled to complement the analysis carried out in loco for pigments identification and the detectiion of poncif technique used by Almada. The work on site was carried out with XpeCAM X02 automatic multispectral camera and with LAMPA, a 3-in-1 UV+VIS+IR single body equipment that operates in parallel to the camera.

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